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Vol. XVIII
No. 5

Contractors and Engineers Monthly

May,
1929

Published Monthly at 443 Fourth Ave., New York, by Buttenheim-Dix Publishing Corporation.

Daily News Building, Chicago
Tom Dix, Vice-President

642 Hanna Building, Cleveland
George Conover, Manager

155 Montgomery St., San Francisco
Roger A. Johnstone, Manager

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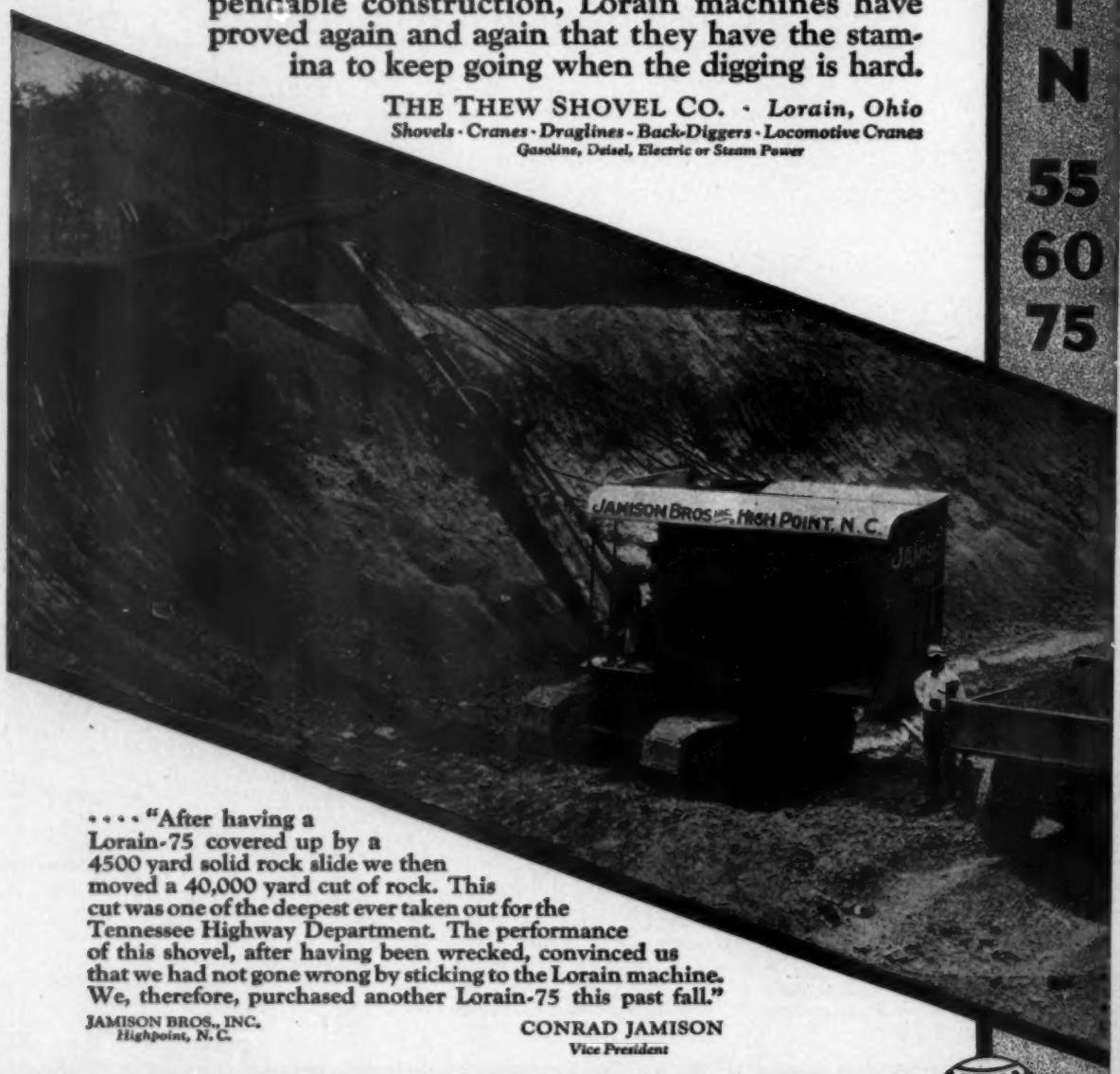

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THEW CENTER DRIVE

T H E W

Vol. XVIII
No. 5

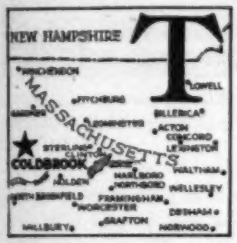
Contractors and Engineers Monthly

May,
1929

The Wachusett-Coldbrook Tunnel

By Howard J. Sprott

Assistant Engineer, Metropolitan District Water Supply Commission

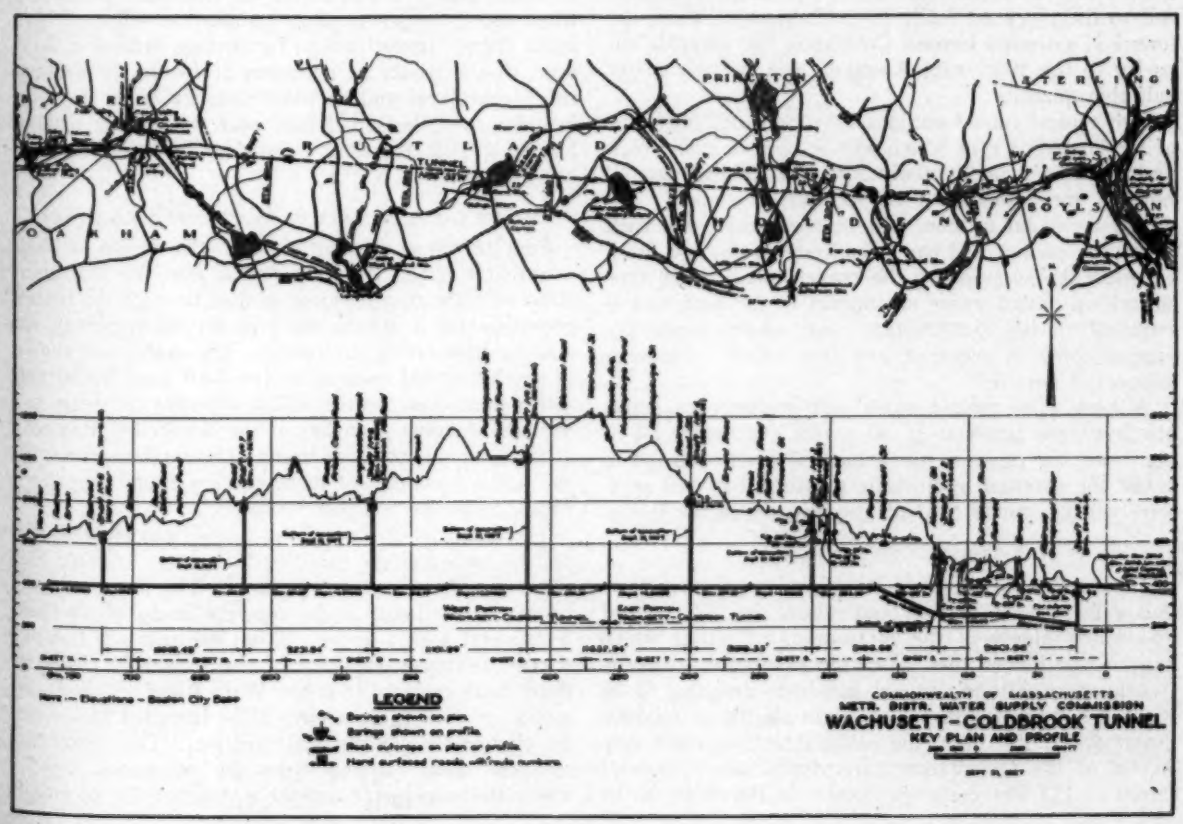


THE Massachusetts Legislature in May, 1922, enacted a bill creating a special Metropolitan District Water Supply Commission to develop a new additional water supply for Metropolitan Boston. The act permits taking the flood waters from about 100 square miles of the Ware River watershed at a point near the village of Coldbrook, the taking being limited to the natural flow in excess of 85,000,000 gallons per day. Fifteen million dollars was appropriated mainly for the construction of a tunnel to divert the flow from Coldbrook into the farthest outlying existing reservoir, the Wachusett Reservoir at Clinton. The tunnel was to be large enough and at a sufficiently low level to allow later extension to the Swift River.

Design of Structures

The general slope of the tunnel is downward from west to east. To facilitate drainage during construction, each heading extending easterly from its construction shaft, instead of sloping downward, is continued level until it meets the upgrade extended westerly from the adjoining shaft. The tunnel will be level for the entire distance between Shafts 7 and 8 to assist the removal at Shaft 7 of air which will be unavoidably taken into the tunnel with the Ware River floods at Shaft 8 at Coldbrook.

At the east end of the tunnel at Shafts 1 and 2, subsurface investigations showed that in order to insure an adequate depth of sound rock about the tunnel arch,



OPERATIONS AT SHAFT 1 OF THE WACHUSETT-COLDBROOK TUNNEL

1. Dam at the site of Shaft 1. 2. View looking southerly at top of shaft, showing hoist with bucket just removed from shaft and track system for handling materials

the grade of the tunnel would have to be lowered about 200 feet more than requirements of the hydraulic gradient would indicate.

TUNNEL SECTIONS

The tunnel will be lined with unreinforced concrete and will have a cross section area equivalent to that of a circle 12 feet by 9 inches in diameter. This will provide a combined carrying capacity of approximately 2,800 cubic feet per second for the flood flows of the Ware River at Coldbrook to the Wachusett Reservoir and to the proposed Swift River Reservoir. Until the tunnel is extended beyond Coldbrook the carrying capacity to the Wachusett Reservoir will be only about half this quantity.

Two typical tunnel sections have been designed, one of the horseshoe type which will be used in sound rock and which will undoubtedly form the greater part, if not the entire length of the completed tunnel. The other, a circular section, will be used where the rock is of poor quality and has a tendency to slip and bring excessive pressure against the tunnel lining. Each type includes a design where no support of the rock roof is required during construction, one where temporary support only is required and one where permanent support is required.

Although the ground water will probably be above the hydraulic gradient at all points practically all of the time, the concrete lining has not been designed to resist the external hydrostatic pressure, but this pressure will be vented through the weepers in the lining.

CONSTRUCTION SHAFTS

In order to accomplish the diversion of the Ware River flood flows in 1931 and relieve any shortage of the water supply of the Metropolitan District which may occur before that date, the construction of the Wachusett-Coldbrook tunnel has been designed to be carried out by headings from eight shafts, as follows: Shaft 1, 205 feet deep, the outlet into Wachusett Reservoir at the Quinapoxet River basin near Oakdale; Shaft 8, 253 feet deep, the intake on the Ware River near Coldbrook; and for construction purposes six construction shafts varying from about 8,800 to 11,600 feet apart and from 313 to 656 feet deep. The construction shafts will have permanent unreinforced concrete linings, 14 feet in diameter.

It was desired to locate the top of Shaft 2 slightly above the future level of the Swift River Reservoir and as near to the Quinapoxet River as possible in order that water from that river might at some future time be diverted through the tunnel to increase the amount of water power available for development at Shaft 1 when and if the power plant installation will have been made there. Investigations by borings indicated, however, that it would be necessary to locate the shaft at the higher level and at some distance from the river in order to strike sound rock near the surface without having to sink the shaft to any great depth in water-bearing earth.

SHAFT 1, THE OUTLET TO WACHUSETT RESERVOIR

Four principal considerations in the design of Shaft 1 were the outlet from the tunnel into the Wachusett Reservoir, the measurement of flow through the tunnel, provision for a future water-power development and also for unwatering the tunnel. The outlet will consist of two horizontal openings at the shaft head discharging into a short open channel which will take the water into one of the upper branches of the Wachusett Reservoir at the Quinapoxet River basin. The retaining walls for the outlet channel are to serve as a foundation for a future hydro-electric power station.

The entire discharge of the tunnel into the reservoir will be measured by two Venturi meters, one for high flows and the other for low flows. The larger one will be vertical and cast in the concrete lining of the shaft. This meter with a 90-inch throat will measure flows up to the maximum capacity of the tunnel for diverting flood flows easterly from the Ware River. The smaller meter of 36-inch diameter will be installed in the outlet channel in a horizontal position. This meter will measure flows ranging from the minimum capacity which the large meter is capable of measuring accurately

down to the lowest anticipated rates of diversion.

Because of the necessity of lowering the grade of the tunnel at the east end to insure support in sound rock, the volume of water in the tunnel below elevation 390, that is, low water in the outlet channel, will be approximately 21,000,000 gallons and provision has been made for handling this amount, plus any leakage into the entire tunnel, by emergency pumping equipment when it is desired to unwater this portion of the tunnel for inspection or repairs. It was finally decided to build, in addition to the main outlet at Shaft 1, an additional pump shaft or well of equal depth but of smaller diameter. This second shaft will be pumped out by a small pump, then a centrifugal pump and motor will be lowered to the bottom and connected for pumping out the tunnel. The entire shaft will be excavated and lined initially as a single shaft and used in that form during the work of excavating and lining the tunnel. Upon the completion of this work, the partitions separating the main outlet shaft and the smaller pump shaft will be installed, the pump shaft having a steel interlining to insure water tightness.

SHAFT 8—THE WARE RIVER DIVERSION WORKS

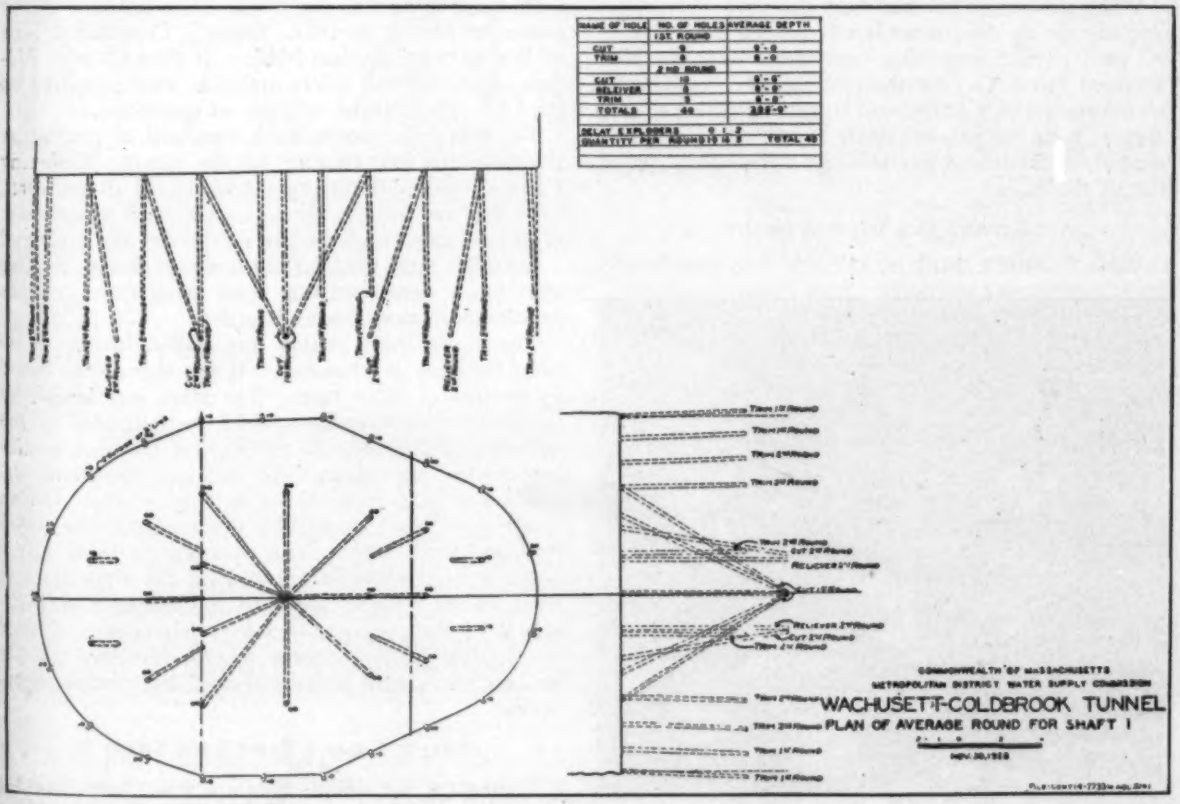
The Ware River intake to the tunnel will consist of Shaft 8 and the diversion control works at the surface. Four principal considerations in the design were: the diversion of the flood flows above the prescribed limit of 85,000,000 gallons daily; the measurement of the quantity diverted and that left in the stream; the exclusion of air so far as possible from the water taken into the tunnel; and the dissipation of the energy due to the drop into the shaft, the tunnel invert being approximately 260 feet below the level of the river. The shaft will be excavated and lined initially with concrete and used in that form during the excavation and lining of the tunnel. When complete the shaft will be lined with cast iron, the results of laboratory tests on a model are to be used in determining the final form of the castings which will make up the finished lining.

SANITARY PRECAUTIONS DURING CONSTRUCTION

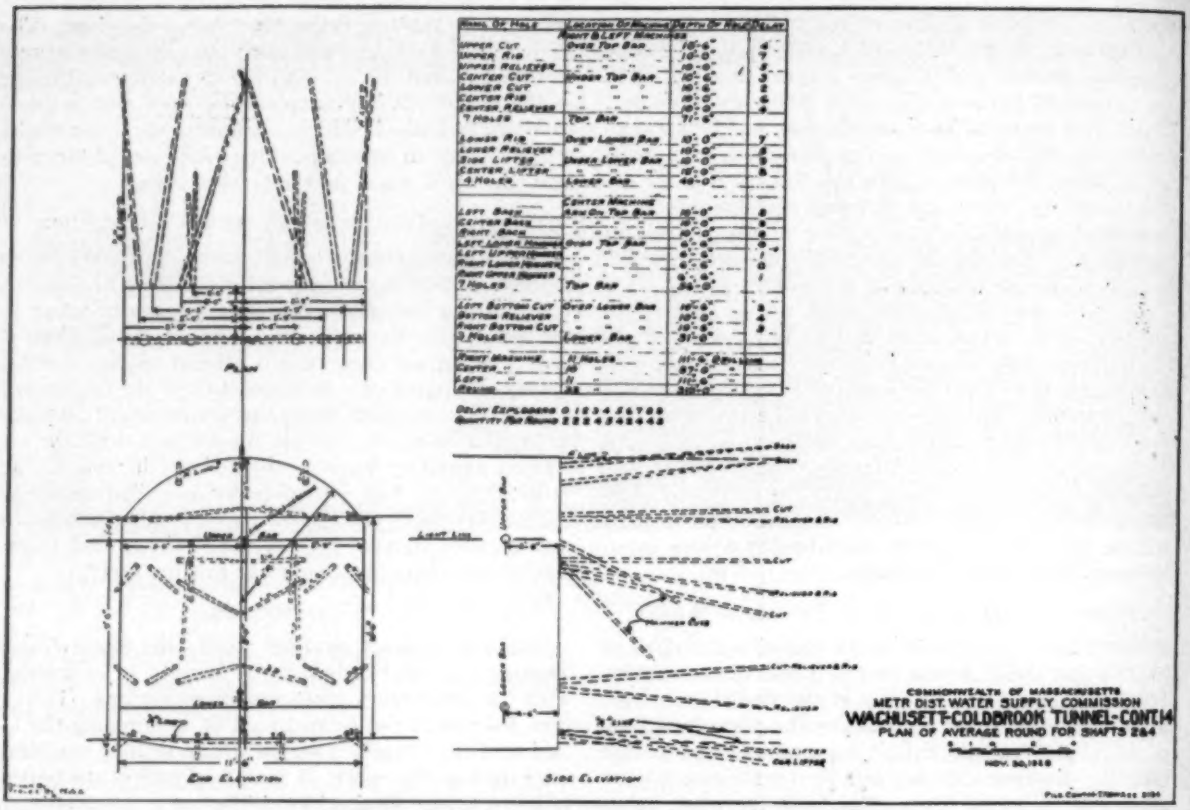
Special sanitary precautions are being taken during the construction operations at Shafts 1 to 4 inclusive, which are located within the drainage area tributary to the Wachusett Reservoir and particularly at Shaft 1 and 2, which are close to this present source of water supply. Extreme care in the control of the contractors employees is required, the camps are inspected carefully at regular intervals and all wastes and drainage are treated. Sanitary work at these shafts include drains, settling basins and provision for chlorination of all surface drainage. At Shafts 1 and 2 slow sand filters are installed to take care of the drainage and insure against any contamination of the existing supply.

CONSTRUCTION

The first contract awarded was to the Pennsylvania Drilling Co., of Pittsburgh, for borings in connection with the preliminary geological investigations. Thirty-nine holes were put down to aid in determining the location of the tunnel. Two gas driven drilling machines were used on this work. A sample of core of the underlying rock was obtained by drilling to a suitable depth with a black diamond studded bit, and representative samples of the overburden obtained at intervals with



Plan of Firing Rounds for Shaft 1 of the Wachusett-Coldbrook Tunnel



The Firing Diagrams for an Average Round in Shafts 2 and 4

the aid of a dry sampling spoon.

When the tunnel line had been definitely determined and run out on the ground it was cleared to a width of 50 feet. The Commission contracted with the New England Power Co., for the construc ion, maintenance and operation of a 22,000-volt transmission line to connect with their lines near Shaft 1, and from there running along the tunnel line to Shaft 8, furnishing power for all shafts.

DRIVING THE DEEPEST SHAFT

Shaft 5, with a depth of 650 feet, was considerably deeper than the other shafts. For this reason the contract for sinking this shaft was let in advance of the others, on March 28, 1927. James J. Coughlan & Sons of Boston were the low bidders at $137,854.80. Bidders submitted unit prices and bids were compared on the basis of engineers' estimate of quantities.

The Storage Battery Locomotive Near Shaft 5

The first construction work consisted of grading at the shaft site and clearing for the camp. Timbering was not required during excavation of the 19-foot earth cover but was placed after rock excavation was started. Wooden frames, made in four sections to the circle and 5 feet high, were used for the concrete lining. Similar steel forms were tried but, upon being found hard to handle and remove, were discarded.

The entire shaft section was drilled in one round using Sullivan jack hammers. It was shot as one round by the use of delay fuses. The muck was loaded by hand into 1-yard buckets which were hoisted to the surface and dumped. At the start of the work a stiff-leg derrick was used. As blasting operations descended it was replaced by a light 40-foot wooden headframe. Rock excavation preceded concrete lining by varying distances. The contractor seemed to experience more difficulty in sinking the shaft on line when he got very far ahead of the lining. Two Sullivan WJ-3 compressors, 14 x 8¼, delivering a total of 1,060 cubic feet of air per minute furnished air for drilling. A ½-yard mixer was used for concrete operations.

SHAFTS 6 AND 7 SUNK LIKE SHAFT 5

Contract 8, for sinking Shafts 6 and 7, was awarded to James J. Coughlan & Sons on May 24, 1927. They

were again the low bidders at $162,125. The equipment and methods at Shafts 6 and 7 were similar to those described for Shaft 5.

METHODS USED AT SHAFTS 2, 3 AND 4

Contract 12, for sinking Shafts 2, 3 and 4, was awarded to the Dravo Contracting Co., of Pittsburgh on May 24, 1927, for $259,800. Shaft 2 is 313 feet deep with ledge 25 feet below the ground surface. In earth, timbering was used consisting of 8 x 8-inch sets spaced 5 feet apart and 2 inches lagging. In rock, the full cross section was removed in one round. Delay fuses allowed the round to be fired in three relays.

The muck was loaded into buckets by hand. A steel stiff-leg derrick with 50-foot boom and 2-drum Lambert electric hoist was used to hoist the buckets to the surface where they were dumped into muck cars which were then pushed by hand to the spoil bank. The shaft excavation was entirely completed before any concrete lining was placed. A ¾-yard Lakewood mixer emptied into a bucket which was lowered and dumped directly into wooden forms. Air was furnished by two Ingersoll-Rand compressors of 446 and 528-cubic foot capacity.

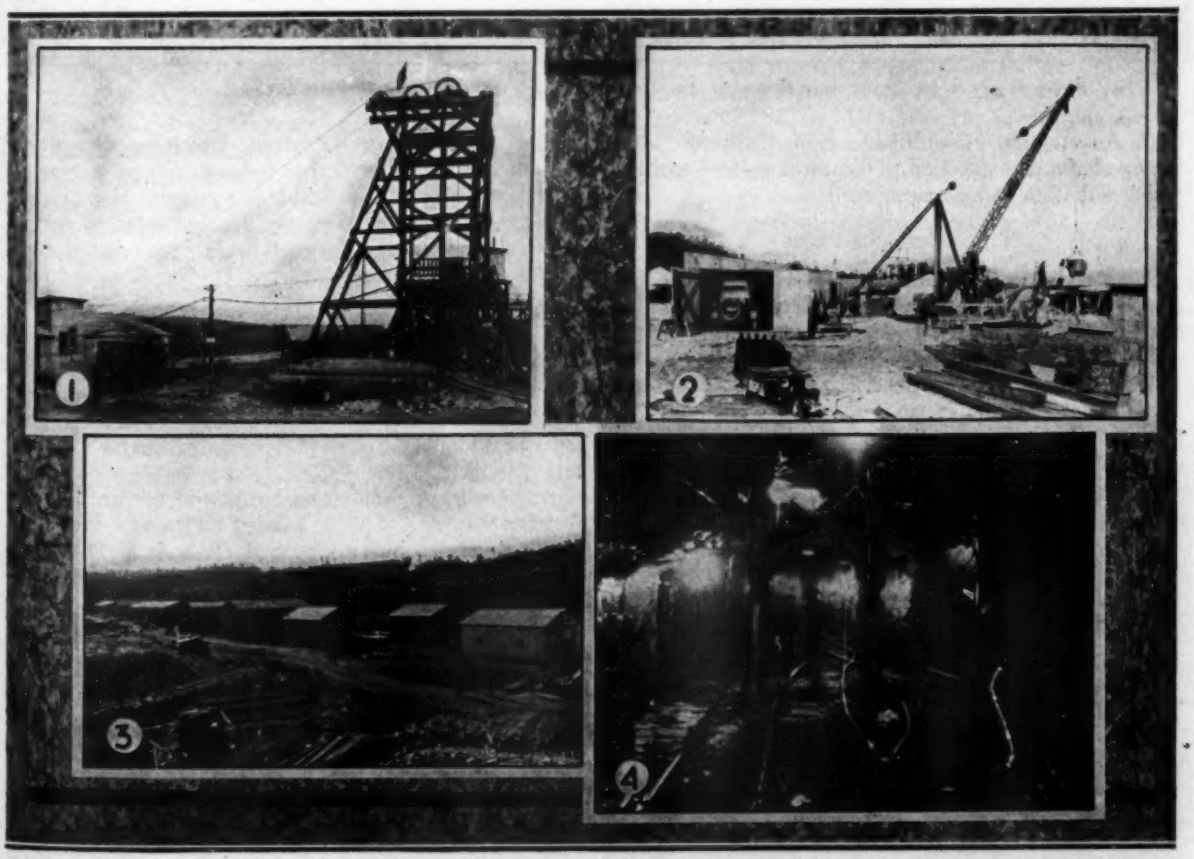
Shaft 3 is 339 feet deep with a depth to ledge of 61 feet. Because of the earth cover here it was decided to sink a reinforced concrete caisson to rock. This caisson was 14½ feet inside diameter, 32 inches thick and was poured in 8-foot lifts. The bottom was provided with a steel shoe for a cutting edge. Other operations were similar to those at Shaft 2.

A steel stiff-leg derrick with a 45-foot boom and Lambert 3-drum air hoist was used for excavation and placing concrete until the shaft reached a depth of 100 feet when a 34-foot steel headframe was erected and a Lambert electric hoist used. Two Ingersoll-Rand compressors, delivering 446 and 324 cubic feet of air, furnished air to the drills and hoist.

Shaft 4 is 457 feet deep with a depth to ledge of 23 feet. Operations and equipment were similiar to Shaft 2 except that when the shaft reached a depth of 65 feet a 40-foot headframe was erected. Two Ingersoll-Rand compressors, delivering 546 and 324 cubic feet furnished air for drilling. A ¾-yard Marsh-Capron mixer was used for the concrete.

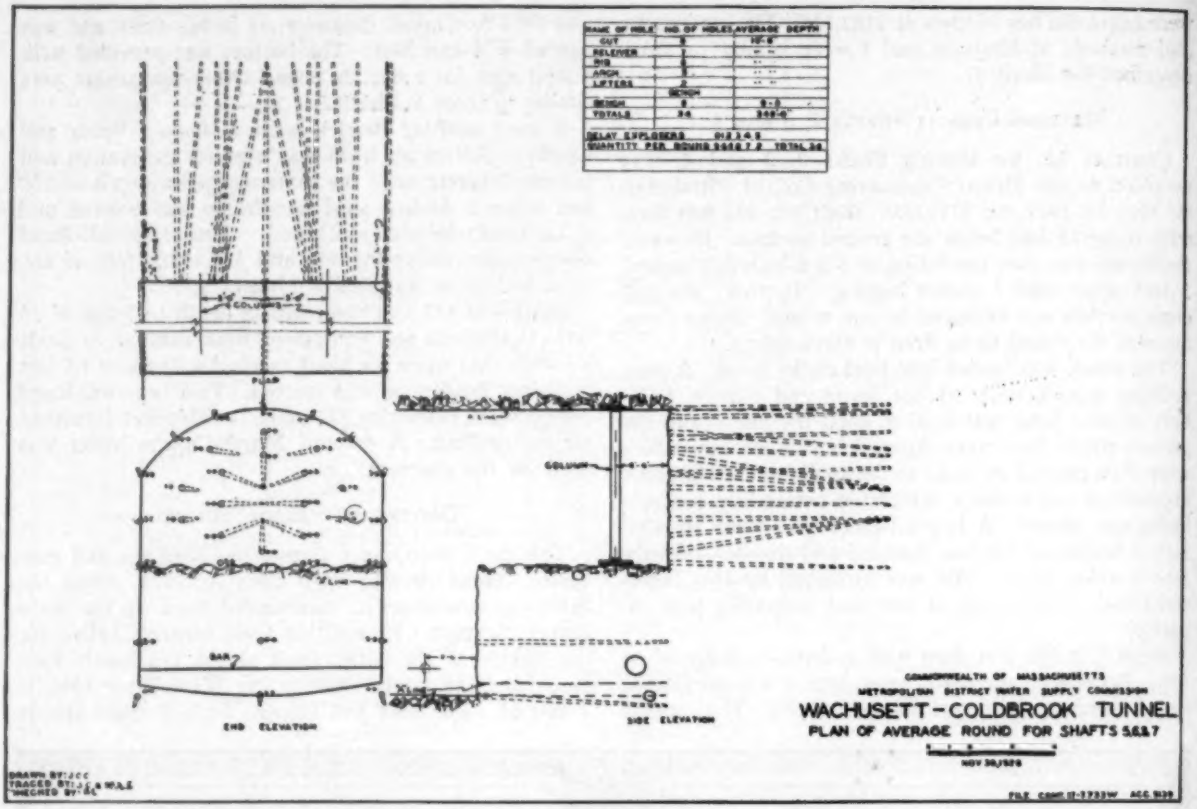
DRIVING THE MAIN TUNNEL

The shaft contractors turned the headings and continued tunnel driving until May 4, 1928, when the West Construction Co., commenced work on the main tunnel contract. In addition their contract called for the sinking of the outlet shaft at the Wachusett Reservoir and the intake shaft at the Ware River (Shafts 1 and 8). The next five months were devoted almost



HEADWORKS AND OPERATIONS AT SHAFT 2

1. Headframe, hoist and compressor house on left, spoil bank on right, blower house and 14-inch stave pipe used for tunnel ventilation in center. 2. Headworks, showing muck being removed by stiff-leg derrick. Camp buildings at Shaft 2 looking southerly from spoil bank at shaft. 4. Tunnel at foot of Shaft 2 looking easterly, showing track system, ventilating, other pipes and wiring



Firing Diagram for an Average Round as Used in Shafts 5, 6 and 7 of the Wachusett-Coldbrook Tunnel

solely to erection of additional camp buildings, timbering shafts, construction of headframes and trestles, and installation of new equipment.

Timbering and Cages

Shaft timbering is similar at all shafts and affords running guides for two balanced non-self-dumping cages. The timbering consists of three cross pieces, one 6 x 10-inch and two 4 x 10-inch timbers, spaced 10 feet on centers, and so placed as to provide two equal sections 8 feet 4 inches by 4 feet 10 inches, each capable of accommodating a cage. These timbers are indirectly held in place against the concrete lining by the screws and expansion bolts. The cage guides are constructed of 4 x 6-inch timbers, those at the sides of the shaft being bolted to 5 x 8-inch timbers which are fastened to blocking which in turn is attached to the lining by expansion bolts. One of the two segmental sections on either side of the cages is used for the different pipe lines to the tunnel and the other as an emergency egress by way of a ladder extending to almost the full depth of the shaft and having landings 20 feet apart.

The cages measure 8 feet 1 inch by 5 feet 4 inches overall, are of structural steel and have two open ends, the sides being closed in by ⅛-inch steel plates, extending for nearly the full height of the cage. The floor is of heavy planking and equipped with 30-inch gage track, except for the cages at Shaft 7 where 24-inch gage track is used, as well as a locking device located in the middle and which engages a cross bar provided in the bottom of each car, thus preventing any movement of the car until released. The cages are equipped with automatic stops, which operate when tension in the hoisting cable becomes nil, as in case of a broken cable. The slackening releases the tension in a cross spring, causing the locking dogs to spring outward and engage themselves in the wooden cage guides. At the various landings, landing dogs are provided.

Excavation in Tunnel Center

Two methods of tunnel excavation are in use: full face, and top heading and bench.

The top heading and bench method of driving tunnel was adopted from the beginning at Shafts 5 and 7, and this method was also adopted at Shaft 6, after the abandonment of the bottom heading in use until about October 1st. At the start, hand mucking was employed in the headings but mechanical methods were substituted from time to time so that at present no hand methods are in use.

After a round has been shot in the heading and bench the drillers go into the heading and muck back from the face for about 3 feet, to make room for setting up the drilling equipment. Two vertical drilling columns are then set up about 6 feet apart and about 2½ feet back from the face. These columns are equipped with extension arms, universal joints, and saddles for the accommodation of 3 Sullivan Water Leyner drills. Air and water lines are brought up the tunnel to within 25 or 30 feet of the headings where they are coupled to manifolds, one for air and one for water. Each manifold has 4 or 5 valves and connections for a 50-foot hose attachment to each machine.

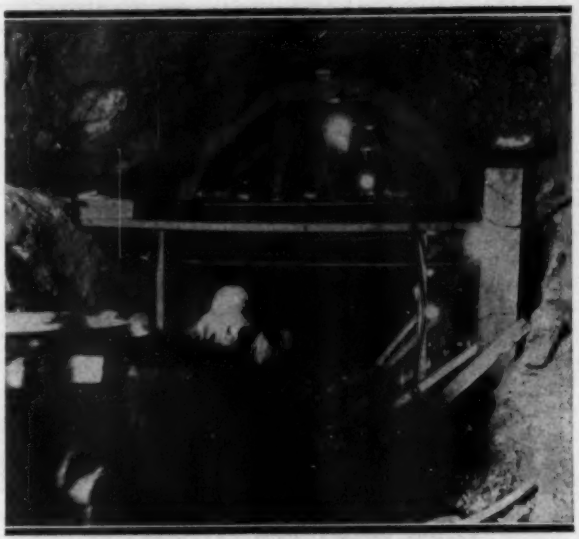
After the heading has been drilled and the face of

the bench cleared of muck, a horizontal bar about 11½ feet long is set across the tunnel. Two Sullivan Water Leyner drills are mounted on this bar to drill horizontal holes for shooting the bench. In an average round 28 holes are used in the heading and 6 holes in the bench. A drilling diagram of an average round, Shafts 5, 6 and 7, is reproduced below. The holes are usually nearly filled with dynamite, the exploder being placed near the bottom. The exploders are connected in series both in the heading and bench. The cut holes, in the heading, are loaded with approximately 50 pounds of 60 per cent dynamite, and the other holes in the heading and bench with approximately 275 pounds of 40 per cent.

When hand mucking is used ¼-inch steel "slick sheets" are laid down close to the bench. After the shot a wooden plank scaffold about 30 feet long is run out over the top of the bench. This scaffold is supported by 3-inch pipes extending across the tunnel and held in place by short lengths of drill steel inserted in holes drilled into the sides of the tunnel. A bench approximately 25 feet in length is maintained which affords ample room for four men to muck on top of the bench without interfering with the drilling crew. The muck from the bench is wheeled out over the scaffold and dumped into cars, which have been run in under the scaffold and at the same time a crew of five men shovel directly into the cars from muck on the "slick sheets" on the bottom of the tunnel. Where mechanical mucking is used a short bench is used, seldom carried over 7 feet, as by this means most of the muck falls out over the bench and can be readily reached by the mucking machines. At Shaft 5 Hoar air-driven machines are used and at Shaft 6 and 7 Butler underground shovels are employed. Empty muck cars are stored on a turnout which is kept within 200 feet of the mucker. One mule hauls loaded muck cars from the heading to the turnout, bringing back an empty car to the heading. Another mule hauls loaded cars from the turnout to the shaft, and brings back empty cars from the shaft.

Full Face Excavation

In the full face method, Shafts 2 and 4, the tunnel was excavated without the use of a bench, drilling being done at first by three Sullivan Water Leyner



Tunnel at Shaft 3, Showing Type of Permanent Timbering

Type T-3 drills, these being replaced later by Ingersoll-Rand S-70 drills, mounted on a horizontal bar. An average round consisted of about 40 holes placed and drilled as shown on the accompanying sketch, although several modifications of this drilling schedule were used. In drilling, the horizontal bar, with a screw jack on one end, was set up across the tunnel about 30 inches back from the face. On this bar there were mounted three Ingersoll-Rand Water Leyner drills, two on the ends and the third with a 5-foot extension arm in the center of the bar. With the bar in this position 21 holes were drilled, the lower holes being reached by turning the machine under the bar. When mucking was completed the bar was moved into the lower position about 2 feet above the invert and the remainder of the round drilled from this position. Muck was loaded by the Conway mucker into Ottumwa 1 2/3-yard steel side dump cars, which were hauled in trains of 6 cars to the foot of the shaft, by 5-ton G. E. storage battery locomotives. After a shot the mucking machine first starts some distance back from the heading, picking up fly-rock and general cleaning up on the invert until it reaches the muck pile. It then

Headframe and Spoil Bank and Detail of Headframe at Shaft 5

Headframe, Trestle and Beginning of Spoil Pile at Shaft 4 Looking Easterly Along the Tunnel Line

proceeds to muck directly to the face of the tunnel. A train of empty cars is hauled into a siding a short distance back from the heading, over which is placed an air lift. By means of this lift an empty car is transferred from the siding onto the main track and pushed by hand to the mucking machine. When this car is loaded the locomotive moves up and hauls it out of the heading to a point behind the air lift, where it waits for another car, repeating the operation until a train of six cars is made up, when it is hauled to the shaft and six empty cars hauled back to the siding near the heading. The shaft cages were operated by Ottumwa Iron Works double reduction single ridge drum hoist with a G. E. 100-horsepower motor. At the top of the shaft the cars were drawn to the spoil pile by Plymouth gasoline locomotives.

OPERATIONS CONTINUOUS

In both methods work is carried on practically continuously. Operations have not been carried on long enough to give really representative progress figures. It is possible with the full face method to drive from 100 to 125 feet per heading per week. With the top heading method 85 to 100 feet range is attained.

Blacksmith Shop at Shaft 7 Soon After the Fire Which Destroyed the Building. Work Was Only Slightly Delayed

Progress falls much below these figures at times, due to delays from water, breakdowns, or other causes.

It is planned to excavate the entire tunnel before any concrete lining is placed. Completion of excavation of the entire tunnel in time to catch the spring freshets of 1931 is contemplated.

PERSONNEL

Frank E. Winsor is Chief Engineer of the Metropolitan District Water Supply Commission; Karl R. Kennison, Designing Engineer; William W. Peabody and Richard R. Bradbury are Division Engineers in direct charge of work. A. C. Dennis is General Manager of the West Construction Co.

Preventing Fires During Construction

THERE have been so many serious fires in buildings under construction causing losses of millions of dollars that definite steps should be taken to improve existing conditions by formulating safer methods of procedure for structural operations. It often happens that builders erect large structures of various types without sufficient thought for the prevention of fire, although decidedly hazardous conditions are frequently present in the shape of wood scaffolding, open flame heaters or salamanders and inflammable packing materials, such as excelsior and wood shavings. The majority of workmen smoke while attending to their duties and give little heed to where discarded matches and cigarettes may find resting places.

In New York City the outstanding construction fires of recent date have been the $3,000,000 church fire on Riverside Drive and the large loss incurred on a partly finished hotel on upper Fifth Avenue. In addition to these instances, there are numerous others being recorded altogether too frequently throughout the United States.

Herbert E. Maxson, Vice-President, Continental Insurance Co., reports a recent survey of a typical structural operation in the east. The costly stone exterior had been erected and the roof was being installed under exceedingly hazardous conditions. Practically the entire front of the building had been enclosed with wood scaffolding and solid wood framing shielding the stone carvers. The wood deck over the street in front of the building had coal stoves over and under it and in the contractors' shanties and tool sheds were two 50-gallon drums of gasoline and quantities of inflammable building materials.

The floor near the entrance was partly covered with straw in which tile or some similar building material had been packed. Close by was a broken packing case and many small pieces of waste wood. At the moment the inspection was being made the loose packing material on the floor became ignited by a cigarette stub thrown from an upper platform. Other hazards encountered were gasoline plumber's torches, open salamanders, loosely hung temporary electric wiring and supplies of gasoline in flimsy cans, all of which endangered first the wood scaffolding and then the structure itself.

Unfortunately, this is not an isolated example, but is one that could be duplicated indefinitely. Under the circumstances, it is hoped that the recommendations now being drawn up by engineers of the Underwriters in cooperation with construction interests will be effective in improving these conditions.

Forty Years of Completed Contracts

THE Miller Paving Co., the Chas. R. Miller Co. and Charles R. Miller, of 556 Suzette St., Memphis, Tenn., have retired from business, owing to the ill health of Mr. Miller. These organizations hold a record of 40 years of continuous service satisfying every customer and having completed every contract without a failure. This is a most remarkable record and one which deserves recognition by the construction fraternity. Our congratulations to Mr. Miller and his organizations.

Mulch Asphalt Surfacing by Contract in British Columbia

By E. R. Taylor

General Construction Co., Ltd., Vancouver, B. C.

DURING the last year or two there has been a growing interest taken all over the North American continent in the cheaper types of bituminous road surfacing. These cheap types of surfacing are of great economic value in the progressive or stage development of road construction. In British Columbia, the General Construction Co., has been one of the pioneers in asphaltic surface treatments and in the last five or six years, has experienced a large increase in the demands for these surfaces.

One of these types is of particular interest and one in which this company has developed a system somewhat different from the ordinary methods. This is the type variously known as "mulch," "turn-over system," and "mixed in place." The General Construction Co., has laid a large mileage of mulch, the oldest project being laid about three years ago.

Methods

The usual way of laying mulch is to scarify the old gravel surface, spray the loose material with road oil, mix the mass thoroughly, lay the mix out and let traffic consolidate it. In our system the road surface is not disturbed except for such preliminary truing up as may be required. On this surface, a predetermined thickness of screened gravel is uniformly distributed. Usually about 700 cubic yards of gravel is spread to the mile on a 16-foot wide road. This amount of material will give approximately a 2-inch compacted surface layer.

Directly on this loose gravel is sprayed a cut-back asphalt at the rate of approximately one U. S. gallon to the square yard. This asphalt is sprayed in two equal applications and the spray truck is followed closely by a double disc farm harrow drawn by a small crawler tractor. All preliminary mixing is done very rapidly by the disc. By using these harrows immediately behind the spray, no interruption to traffic is experienced.

The harrowing is continued on the first stretch laid until a fresh tank of asphalt arrives. Then the discs move up and mix the second stretch as it is sprayed. After about 2,000 gallons have been sprayed, two power graders set to work to do the final mixing. It is often necessary, especially on narrow road beds, for the tractor to unhitch and pull one of the graders up each side to give them an easy start. The tractor usually

PROGRESS PHOTOGRAPH OF THE MULCH METHOD OF SURFACING GRAVEL USED BY THE GENERAL CONSTRUCTION COMPANY, LTD.

1. Mulching gravel laid out ready for mixing with asphalt. 2. Power grader making a final mix on a mulch after spraying with asphalt and harrowing. 3. Distributor spraying the seal coat on mulch 18 feet wide. 4. Rolling the mulch. 5. The first surface laid in British Columbia three years ago. This photograph was taken in October, 1928. The road has handled about 1,000 vehicles a day at a maintenance cost of less than $100 per mile per year

has plenty of time to do this between tank loads. The graders mix and remix the aggregate until all the particles are covered with a film of asphalt.

The completed mix should have a dull, very dark brown color, although this color will vary with the aggregate and the class of asphalt used. The lower the penetration of the asphalt the darker the mix will be. In British Columbia a heavy liquid asphalt as defined by Imperial Oil specifications, cut back with 10 per cent of either distillate or stove oil, is used. This material is used at a temperature of about 250 degrees Fahrenheit.

When the mix is completed the whole mass is laid out uniformly over the surface by the graders. After traffic has consolidated the surface for a time varying from a few hours to a day or two, a heavy steel drum farm roller is used to smooth up the surface and punch down pebbles and small stones which may appear. At first, we did not resort to rolling, but allowed traffic to do all the consolidating. This procedure worked very well, except that the texture of the surface appeared to be too rough and bumpy. A heavy roller was then tried. This, in turn, had a tendency to push the mix into ridges and ripples. The light farm roller was then resorted to with excellent results, giving a final rolled surface having a very neat, even texture.

SEAL COAT

When the surface has set up to a point where a tire makes no impression, a seal coat of straight heavy liquid asphalt is applied at the rate of 1/5 U. S. gallon to the square yard. This coat is blotted with coarse sand from piles previously spotted along the shoulders. The resulting wearing surface has the appearance of asphaltic concrete, and if placed on a firm base, has remarkable wearing qualities.

The first piece of this type of surfacing laid by the General Construction Co., three years ago is still intact and has carried an average of 1,000 vehicles per day during that time with very little maintenance.

CHOICE OF MATERIALS

A few words should be said with regard to the choice of asphalt and the grading of aggregate. After considerable experimenting, we finally fixed on a heavy liquid asphalt as a binder. The lighter asphalts and road oils made a too porous and weak a mix to stand up under Canadian winter weather conditions, along the coast. Our winter season is very wet with occasional rather severe frosts, accompanied by snow or sleet. These conditions require a thoroughly impervious surface, hence the seal coat. Toughness of the mix is also essential. Hence, a binder is used heavier than is generally used on this class of surface. Susceptibility to scarification and re-shaping is also essential. If a heavier asphalt were used it would be difficult and expensive to re-shape it. Toughness of the mix depends to a great extent on the grading of the aggregate. As a rule, we have found most of the run of bank gravel aggregates to be short in fine sand. This additional sand often has to be hauled in over the loose gravel and distributed in the proper proportions before spraying the asphalt. As a rule, considerable fines may be obtained from the dust of the original road surface.

SUMMARY

The total amount of screened aggregate per 10,000 square yards of surface is approximately 700 cubic yards loose measurement. In addition, about 60 cubic yards of coarse sand for blinding is required. The gravel should contain no pebbles larger than one inch and preferably should grade within the limits allowed for a coarse mix asphaltic concrete.

The asphalt will run very close to 1.2 U. S. gallons per square yard for these amounts of aggregate. It is absolutely essential that this type of work be done early in the season and in dry weather. The surface will be a failure if wet, cold weather arrives before the mix has had a chance to thoroughly dry out and set. On the other hand, it is not essential that the gravel be absolutely dry when being mixed just as long as plenty of drying weather is ahead to get rid of any moisture before the winter season sets in. With the equipment mentioned, one-quarter to one-half mile of 16-foot pavement can be laid per day.

The writer believes that this type of surface has come to stay and with improved technique, consistently good jobs can be relied upon at a fair price.

Blasting Cemented Gravel for Road Material

IN temporary roadside gravel pits opened to provide material for secondary highway construction, a deposit may be encountered that requires blasting before it can be excavated. Such gravel formations often contain a clay binder which makes the material quite desirable for road work, but the clay content, due to weather action, may have cemented the gravel until it may be almost a conglomerate rock.

If the proposed roadside gravel pit will carry a working face of 15 feet or higher, the well drill system of blasting will be the most economical. Well drill holes from 4 to 6 inches in diameter are drilled the full depth of the working space and this entire depth is blasted in one lift. A small well drill may be rented with an operator at from $20 to $25 per day or at a price of from $12 to $15 per day for the machine only without the operator. If 15,000 yards or more of material is required, the purchase of a well drill may be justified.

The per foot drilling cost of cemented gravel with a clay binder usually averages between 15 and 30 cents. The per cubic yard drilling cost would be between ½ cent and 1½ cents, depending upon the spacing of the well drill holes which in turn is governed by the hardness of the material and the height of the gravel bank.

If the working face of the gravel pit will be less than 15 feet in height, the drilling can be handled by small air drills driven by a portable gasoline engine-driven air compressor. Hand churn drills may be employed on small jobs.

Black powder is considered the most suitable explosive for blasting cemented gravel under ordinary conditions. This is because it produces a slow, heaving action which does not throw the material, but merely shakes it up in such a manner that the shovel or other loading machine can handle it easily. Dynamite, on the other hand, has a tendency to throw the material over and down and this is not necessary. Furthermore, black powder is cheaper than dynamite, but it cannot be used if the holes carry any water. A ratio of from 3 to 6 cubic yards of blasted material may be expected to 1 pound of explosive employed. By the proper planning of the drilling and blasting, cemented gravel can be brought down in condition for shovel or clamshell loading at a combined drilling and blasting cost of from 3 to 8 cents per cubic yard.

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A Well-Managed Cast Iron Water Main Job

Two Contractors Handle 4521-Ton Job In New York and Connecticut In Expeditious Manner

EFFICIENT handling of cast iron pipe on the job was very much in evidence recently in Greenwich, Conn., when the contractors engaged in installing the pipe lines in connection with the extension of the Greenwich Water Co.'s supply line obtained excellent results with simple and inexpensive methods which showed thought and organization behind them.

For some years the town of Port Chester, N. Y., which is adjacent to Greenwich, Conn., has purchased its water supply from the Greenwich Water Co. Recently, a change from the existing pressure of 75 pounds to a new pressure of 118 pounds per square inch appeared advisable. At the same time the nearby town of Glenville, Conn., decided to purchase its first public water supply from the Greenwich Water Co. Thus, it became necessary to construct a 24-inch pipe line from Greenwich to Port Chester.

The Unloading Crane at the Railroad Yard

Extent of Work

This new pipe line consists of approximately 31,000 feet of 24-inch cement-lined cast iron pipe reducing near Port Chester to a 20-inch line 4,600 feet in length.

Unloading Pipe at the Trench Side

At the same time a line of 12-inch and 8-inch DeLavaud centrifugally cast iron pipe was laid from Greenwich to Glenville.

All pipe required in the construction of these lines, amounting to a total of 4,521 tons, was made by the United States Cast Iron Pipe & Foundry Co. On January 24, 1927, the first carload of the 20-inch pipe was received at Greenwich and construction of the line was started immediately.

Trenching

Trenching for these new lines was extremely difficult in certain places due to the rocky formation of the land in this district. For instance, in Connecticut 19.5 per cent of the line was laid through solid rock, while the section in New York State included 8.5 per cent solid rock excavation. In the excavation for the Glenville branch 19.05 per cent was rock. These rock formations made necessary extra earth excavation over

Line of Pipe at the Trench Side Ready to Be Lowered by Sections

Careful Handling of the Pipe Protected the Cement Lining as Well as the Coating on the Outside of the Pipe

standard trench dimensions, the extra excavation running 0.0251 cubic yards per lineal foot of trench in Connecticut and 0.077 in New York State. On the Glenville line this extra excavation work ran 0.002 cubic yards.

Line Completed Through Section of Solid Rock Trench

JOINTS

Lead joints were used entirely on the Port Chester line, the lead being 2½ inches in depth on Class C pipe, while on the lighter pipe 2 inches of lead was used. A self-calking substitute for lead was used in the joints on the Glenville mains, poured to a depth of 2½ inches.

UNLOADING PIPE

One of the remarkable phases of the installation was the ease and safety with which the pipe used on the work was handled. As the pipe arrived at Greenwich from the Chattanooga, Tenn., foundry, it was shunted onto the railroad siding to await unloading. A stationary crane made it possible to unload the pipe directly from the cars onto the trucks which were to haul it to the desired location. This crane had many obvious advantages over the methods sometimes employed in rolling the pipe out of the cars and letting it drop to the ground. A simple and efficient sling shown in the illustration was used on the pipe while it was being raised by the crane. Such a sling prevented damage to the cement lining of the pipe as well as protecting the outside coating.

The same care exercised in unloading the pipe from the cars was also used when unloading the pipe from the truck at the trench side. Stringers were laid from the side of the truck and the pipe rolled down over the dirt pile and over the open trench, its speed being controlled by a cable from the truck.

Upon unloading at the point of installation, the pipes were lined up along the curbing of the street with the bells facing in the direction in which the work was to proceed. Unloading the pipe in this manner

caused the least possible annoyance to the traffic on the highway beside which the pipe was to be laid.

The trenches were dug by hand because of the nature of the soil. There was one advantage in the large amount of rock excavation, namely, that the trenches required no bracing. Particular care was necessary in backfilling, to avoid the possibility of any rock remaining in contact with the pipe which might later cause trouble.

LOWERING PIPE INTO TRENCH

The pipe was lowered into the trench with a simple three-legged derrick. Here, too, care was taken not to crack the lining. The pipe was rolled over the trench on wooden skids, the rope sling adjusted until the pipe was in balance and the pipe then raised slightly to allow for the removal of the skids. The pipe was then lowered slowly to the desired position in the trench.

CUTTING

All necessary cutting of lengths of pipe was done by machine. The contractors were not allowed to cut the pipe with chisel and hammer as a safeguard against damage to the cement lining.

JOINTS CALKED PNEUMATICALLY

All joints on the Port Chester line were made up with lead. These joints were calked pneumatically with air hammers. It has been found that air-driven joints are far superior in tightness to those calked by hand. In this way as much as one-eighth to one-quarter of an inch can be taken up over the hand-calked joints without danger of splitting the bell. Also, when large quantities of pipe are laid, such as was the case on this job, it becomes a necessity to calk the joints with air in order to keep up with the pipe laying crew.

Lowering the Cement-Lined Pipe Into the Trench with a Tripod

Cutting a Cement-Lined Pipe by Machine, as the Use of Chisels and Hammers was Forbidden

LINE TESTED WITH AIR

In testing these lines, it was necessary to use air rather than the usual water test, because of the lack of water for such purposes. Where water was available, however, comparative tests were made. In testing with air it was decided to use an air pressure of from 60 to 70 per cent of that employed when water was used. This meant that an air pressure of not less than 30 pounds per square inch was to be used in all tests. Testing with air is a great deal more severe than testing with water as air will reveal the weak spot in a joint in many cases where water will not. Consequently, the contractors realized some difficulty in maintaining a constant test pressure. Leaks were detected by swabbing the joints with soap suds and leaky joints were cut out and recalked until tight.

PERSONNEL

All construction work on both pipe lines was under the direct supervision of Stone & Webster, Inc., Boston, Mass. The subcontract for pipe laying in New York was awarded to Daly & Merrit, Inc., while the pipe work in Connecticut was done by Peter Mitchell, Inc.

ACKNOWLEDGMENT.—Reprinted by permission from the U. S. Cast Iron Piper.

Cleaning Rust from Steel Pipe With Steam

AN interesting experiment in the cleaning of steel pipes was made recently in the Equitable Building, 120 Broadway, New York when a vertical steel pipe line 3 inches in diameter and extending from the sub-sub-basement to the 35th floor was cleaned of all rust incrustations resulting from 15 years' use, in one hour. The demonstration took place before a number of engineers and representatives of the United States Steel Corp., the National Tube Co., and other organizations.

The method is to fill the pipe with steam for about 15 minutes, thus heating it for its full length. This is followed by flushing with cold water which washes down the loosened iron oxide. The procedure is repeated as many times as is necessary, until the entire line is cleaned.

The idea of using steam for removing rust was originated by Carl W. Poulson, Chief Engineer, Equitable Building, in January. Since then Mr. Poulson, C. T. Coley, Operating Manager of the building and Joseph W. Degen, Supervising Engineer have been experimenting in the cleaning of various sizes of steel pipe lines using steam pressures ranging from atmospheric to 150 pounds per square inch. Thus far great success has been realized in the cleaning of 2,500 feet of pipe ranging in lengths from 250 to 500 feet.

As yet this process can be used only in pipes that are free to expand when the steam is admitted and considerable work remains to be done on the process in order to make it applicable to all sizes of pipe with as low a steam pressure as possible.

The Eternal Triangle—Engineer—Contractor—the Public

By William E. Morthland
Porter County Surveyor, Indiana

The honesty that is unswerving,
The truthfulness that abhors a lie,
The helpfulness which lightens the burdens of life,
The human sympathy which gladdens aching hearts,
The honor which scorns to take a mean advantage,
The courage which always dares to do right, and
The courtesy of kindliness

THE Engineer is given by the public a great amount of authority in the management of its affairs and with that authority he takes on a great responsibility. He should have the good of the public close to his heart. He should be working for it with an honesty of purpose to secure work of a quality in keeping with the amount of money it is advisable to spend. In the planning of his work his whole energy and ingenuity should be devoted to his public, with no other consideration than securing for it a class of workmanship in its structures which, when properly viewed in the light of modern economics, most nearly fills the wants of the community.

In his zeal for fine workmanship, in his appreciation of beauty, in his ideals of technique, all his plans are inclined to be executed with the idea of perfection. Sometimes perfection must give way to practical considerations; two miles of road of lesser design may serve the needs of the community better than one mile of road of the highest design. In frankly designing a structure supplying this demand for cheapness great care should be used in not sacrificing those things which make for permanency and economy of maintenance, but when once the structure is under contract it is a poor time for the engineer to have a change of heart and demand of the contractor those things which originally were never a part of his plan. He who will through cowardice under public criticism, demand of the contractor things never contemplated in his original design is not playing the part of a real man with the contractor. Such action on his part will eventually make the contracting fraternity wary of work under his jurisdiction, and bids on his work will reflect this distrust in being higher than they otherwise would be. On work where his ideals may justly be given full vent his plans and specifications should so clearly express his intention of demanding perfection of detail that there is no chance of misunderstanding. Here in his relations to the public, perfection should be demanded.

The public has a right to expect in its engineer a reasoning power to correctly interpret its needs and an ability to express those needs technically and clearly in plans and specifications. The public has a right to demand of its engineer that once its needs are expressed in plans and specifications those needs are fully delivered by the party contracting to deliver. I believe the public is entitled to courtesy and respect when it has suggestions to make. I believe the public is entitled to open frank expression by its engineer on matters pertaining to its welfare, entrusted to him. I believe the public is entitled to have for its engineer a man with backbone, unafraid to champion the cause of right as he sees it whether favoring the contractor or the public. Having such an engineer, my confidence in public fairmindedness leads me to believe that engineer will hold public respect and support.

What May a Contractor Expect?

What might the contractor have a right to expect from the engineer? The contractor might first of all expect courtesy and a friendly and helpful attitude. The contractor should feel that nothing short of that specified will be allowed on his job, knowing full well that the same honesty of work is being demanded of his competitor. The contractor has a right, when having delivered a job according to plans and specifications, to be protected by the engineer against unjust demands and criticism.

The engineer, interpreting the needs of the community, makes the laws by which some contractor constructs the structure filling those needs. Comparing his functions to the functions of government, legislative, executive and judicial, his field may truly be considered legislative when he plans his project. It is somewhat executive when he lays out line and grade for the work. It is very much judicial when he must judge whether his laws of construction are being truly lived up to, whether demands by certain influences helping to pay the bills are just and a part of the contractor's obligation. Yes, the engineer needs some fundamentals of conduct if he is to hold the respect of his community when acting in such a varied capacity. The legislator is flattered, cajoled, and sometimes even bribed, by those seeking special legislation. The executive receives his special attention by those seeking favors. We hate to think of judges even approached by anyone with any but the highest of motives, but judges we know are banqueted, are courtesied and even flattered by people with selfish intent. I am inclined to believe the successful legislators, executives and judges must each have some code of ethics, some creed or exceedingly good sense, or how else could they from year to year under such pressure maintain their independence, their self-esteem and public confidence?

As engineers, we know that we are sometimes more popular, more banqueted, more sought than our own personalities of themselves would warrant. We know, that from contractor's and material men's viewpoint, when their motives are the most honest, a close friendship with the engineer is desirable. Such friendships are often proper and make for better relations and understandings. Contractors know that friendships are cemented in play. We should know that play is sometimes costly and few engineers can afford a great outlay along these lines. The contractor and material man, being usually the more prosperous, is inclined to foot the bill. All this can be with the best of motives. We can any of us see, with the contractor more prosperous

it is perfectly natural for him with his more expensive tastes to take his young friend along with him and foot the bill, which in moderation may be perfectly proper. Nevertheless, for the young engineer to throw aside all restraint and allow himself pastimes he can not afford, and at the expense of others, soon places him under obligation. This predicament can be most destructive to his good intentions of conducting himself in his official capacities unbiased and above board. Such a predicament can and often has defeated the young engineer in meeting his obligations, both to the public and to the contractor. Such a predicament can haze his mind and otherwise unfit him for his duties.

AN ENGINEER'S CREED

As a useful creed for the engineer I have copied one which applies equally well to him in his relations to contractor and public; one which I found in the "Monad," when a young fellow in the army. I keep it handy to freshen my memory:

"The honesty which is unswerving,
The truthfulness which abhors a lie,
The helpfulness which lightens the burdens of life,
The human sympathy which gladdens aching hearts,
The honor which scorns to take a mean advantage,
The courage which always dares to do right, and
The courtesy of kindliness."

ACKNOWLEDGMENT.—From a paper read at the Fifteenth Annual Purdue Road School.

Public Works Construction on Increase

THE enormous strides made in public works construction in the United States during the past decade is cited as a significant post-war trend in the survey of the National Bureau of Economic Research shortly to be published with the report of the Committee on Recent Economic Changes of the President's Unemployment Conference.

Figures are given showing that nearly $1,000,000,000 was expended in 1927 for waterworks, sewers, bridges, streets and roads, excavation, drainage and irrigation by counties, towns, cities, states and Federal government, whereas less than $400,000,000 was spent for the same purpose in the year after the close of the war. A comparison of present expenditures with those of the year before the war, when considerably less than $200,000,000 went for public works, is still more striking.

At the end of 1927 upwards of $5,500,000 had been invested in this class of construction during the post-war period. The Federal government has been spending less in this direction, however, in recent years than it did in the years immediately after the war, the figures show.

The survey of the National Bureau of Economic Research was made at the request of the Committee on Recent Economic Changes following the appointment of the latter body in January, 1928. The experts of the National Bureau have since then been steadily occupied gathering data for the Committee. The latter concluded its deliberations on March 2. The survey is an exhaustive inquiry into economic trends and changes in the United States during the post-war period. The report, based on the survey, is a critical appraisal of factors of stability and unstability in our economic life. The report will be ready for publication in May, it was announced today by Edward Eyre Hunt, Secretary of the Committee.

The total annual expenditures by years for public works, as given in the survey follow. In 1913, $192,893,000; 1919, $398,152,000; 1920, $406,729,000; 1921, $459,042,000; 1922, $521,079,000; 1923, $630,424,000; 1924, $685,673,000; 1925, $719,212,000; 1926, $811,741,000; 1927, $932,703,000.

In the same period, the Federal government's public work expenditures were: 1913, $41,751,000; 1919, $72,375,000; 1920, $36,562,000;1921, $28,604,000; 1922, $43,552,000; 1923, $47,940,000; 1924, $38,885,000; 1925, $34,272,000; 1926, $50,262,000; 1927, $50,763,000.

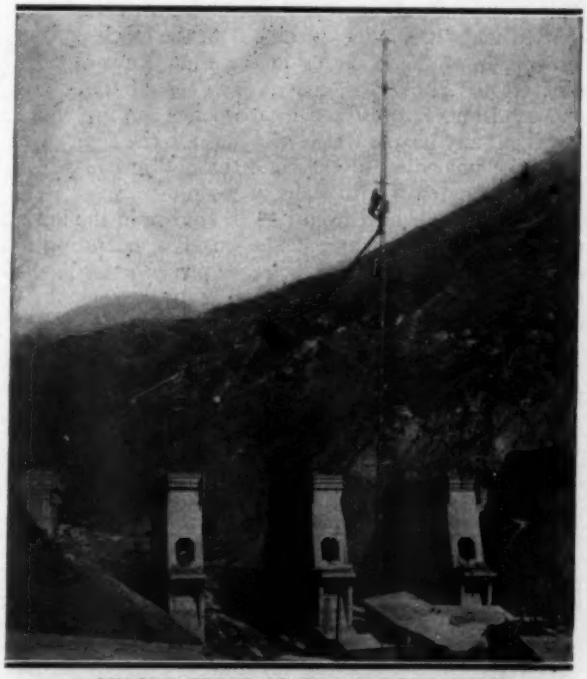
Beginning with 1919 over half of these expenditures have been for roads and streets, which were as follows: In 1913, $58,407,000; 1919, $226,655,000; 1920, $262,641,000; 1921, $313,303,000; 1922, $334,694,000; 1923, $361,837,000; 1924, $415,216,000; 1925, $421,039,000; 1926, $484,898,000; 1927, $525,069,000.

Data on construction was gathered by the National Bureau's experts under the direction of Dr. John M. Gries, chief of the division of building and housing of the Department of Commerce.

The Committee on Recent Economic Changes is a continuation of the President's Unemployment Conference of 1921 which, through a sub-committee on Business Cycles and Unemployment, made a report in 1922-23 on booms and depressions, also based on a survey by the National Bureau of Economic Research.

The Committee as now constituted is made up of President Hoover, Chairman; Walter F. Brown, Renick W. Dunlap, William Green, Julius Klein, John Lawrence, Max Mason, Adolph C. Miller, Lewis E. Pierson, John J. Raskob, A. W. Shaw, Louis J. Taber, Daniel Willard, George McFadden, Clarence M. Woolley, Owen D. Young, and Mr. Hunt, Secretary.

The conclusions of the Committee, as well as the survey data, will be published for public use. Mr. Hunt said that the report and survey would be issued by the McGraw-Hill Book Co., under the title "Recent Economic Changes."



A SINGLE STEEL MAST 280 FEET HIGH

The W. H. Rohl Co., Los Angeles, Calif., is using this Insley mast hoist 280 feet high in the construction of the Little Dalton Canyon dam near Los Angeles. The mast hoist is equipped with a one-cubic yard bucket, and also carries two 40-foot sections of chute and a 30-foot section which connects the mast hoist with a set of 50-foot double counterweight chutes. These double counterweight chutes are suspended from a cable stretched across the canyon anchored at each side and imposing no load whatever on the steel mast. The counterweight chutes can be shifted back and forth on this suspension cable.

A Small Successful Ready-Mixed Concrete Plant

Jahncke Service, Inc., Material Dealers, Operate Well-Designed Unit in New Orleans

SELECTION of location has been preached continuously since the commercial ready-mixed concrete plant became a fact. Jahncke Service, Inc., leading material dealers in New Orleans, La., believing that there was a field for the sale of a first-rate ready-mixed concrete, designed and erected a complete plant capable of producing about 20 cubic yards of concrete per hour. The plant is located in a wooden building measuring approximately 30 x 30 feet in plan and located in the company's material yard at Claiborne Street and New Basin.

A Brownhoist electric pier crane operated from a third rail handles all aggregates in the yard for both building supply and the ready-mixed concrete plant. This crane unloads sand and gravel from railway cars spotted under the crane, placing it in the stock piles at either side of the crane or in the Blaw-Knox wooden bins erected above the mixer. The top of the gravel and sand bins is protected by a wooden grating which keeps out any boards which may get into the aggregates from the unloading of the cars, the bottoms of which have been patched with slabs of wood.

Cement is unloaded from cars to storage in the lower part of the building and if the mixer is operating at the time the car is spotted, bags are placed immediately on the Jeffrey bag elevator which delivers them to a small inclined chute on the operating floor where 150 to 200 bags of cement can be stored. When the plant is operating with the storage space on the upper floor filled with cement, only one man is required for operation, providing the plant is not operating to full capacity. When this occurs an additional man is needed. Another laborer is added when cement must be delivered from the ground floor to the operating floor. Jahncke Service, Inc., believes in selling a concrete of known quality, so it standardizes on its aggregates and Lone Star cement, guaranteeing a concrete of known strength.

Exterior of the Jahncke Ready-Mixed Concrete Plant

Batcher

The upper floor is so arranged that with one batch in the Ransome one-yard mixer, there can be a second batch in the hopper, of the same or different proportions, ready to be delivered to the mixer and a third batch in the Blaw-Knox batcher. These batchers have the elevation for various proportions marked plainly in white paint on the sides, so that the operator can quickly change the batcher for the varying proportions specified by customers. Delivery of the proportioned aggregate from the batchers is handled by the usual levers. The batch that is to be delivered from the hopper into the mixer is released by a gate, in turn the batch in the mixer is dumped into the trucks by means of a wire rope control on the mixer platforms controlled by the operator.

All batches, unless otherwise requested, are given a 2-minute mix and one minute allowed between for discharging and loading the mixer.

Electric switches for controlling all of the operations within the plant are banked behind the operator as he stands immediately above the mixer and with the batcher at his left.

Water Control

The exact amount of water for each batch is shown by the level in a glass water gage immediately in front of the operator. The mixer is operated by a Western Electric 40-horsepower motor, direct connected to the mixer. This is somewhat larger than is actually needed for the operation of the mixer, but was on hand when it was decided to build the plant. The motor has a circuit breaker to protect it.

The plant was designed by A. G. Becker, who is Superintendent for the company. J. W. Stuart is in charge of the plant.

Atlantic City to Have 1930 Road Show

THE American Road Builders Association, at its annual meeting in Washington, May 3, announced that the 1930 Convention and Road Show will be held in Atlantic City, January 11-18, 1930. Atlantic City was chosen for the 1930 meeting after a long and vigorous fight on the part of Cleveland to have the road builders return there.

Set Up a Cost System When You Set Up Your Machine

A System of Recording Initial Costs and Depreciation of Construction Equipment Essential to a Contractor's Business

JUST what are your costs in starting a new shovel on the job? The outline below, published through the courtesy of the Thew Shovel Co., Lorain, Ohio, from its copyrighted Thew Handbook is simple, easily used and does not require the services of a certified public acountant to put it into use. If you will study this a bit you will see many good points about it that will either suggest improvements in your present bookkeeping methods or will give you the desire to start getting more cost figures on your equipment. The values and rates shown are nominal, used arbitrarily for purposes of illustration.

Item 1, the cost of a machine f.o.b. factory is the initial cost, and is the way in which heavy machinery is sold, loaded free on board freight cars by the manufacturer and the purchaser pays the freight.

Item 3 covers the expense of placing the machine on its initial location. This is an item to be considered when the machine will be used at one permanent location, such as at a quarry, gravel pit or a mine. When the machine is to be used on contracting work and will be moved from one location to another frequently, it is customary to include the cost of moving the shovel or crane in the cost of moving the entire contracting outfit which is figured as one item in estimating the job, so that the cost of placing the machine on its first location need not be included as part of the investment or first cost.

This item may also include such incidental expenses as building a road, strengthening a bridge or, in the case of an electric machine, the setting up of the transformer and poles and the purchase price of conductor cable. Also, where unusual difficulties demand excess time of erecting engineers or partial dismantling and reassembling of the machine, the cost is important and becomes a part of the cost of the outfit. All these should be charged as part of the original investment.

Item 4, the total first cost, includes items 1, 2, (the freight) and 3 which give the total first cost of the machine placed on the job and ready for work. This should be used as the basic figure in computing the fixed charges.

Item 5, depreciation or amortization, is important. The rate at which a power shovel or crane is depreciated or amortized depends on conditions, the kind of work being done or on the individual operators or owners. A common basis is to figure the useful life of the machine in a given number of years and to arrive at the annual rate of depreciation by dividing the first cost by the given number of years. On construction work, excavating machinery is usually considered as having a useful life of five years, and, is therefore, depreciated at 20 per cent anually. On permanent plants, such as stone quarries and sand and gravel operations, the depreciation rate is commonly figured at 10 per cent annually. It is better, however, to write off at least 20 per cent during the first year of operation and 10 per cent each succeeding year. Then the machine is off the books at the end of nine years. It is a known fact that a piece of machinery depreciates from the standpoint of resale value much faster the first year than in any succeeding year. This does not affect its true operating value, but it is well to take advantage of this situation and write off the larger amount the first year.

The method of figuring depreciation described above is known as the "straight line" method. There is also another method, known as the "sinking fund" method which goes deeply into mathematics and which does not depreciate the value quite as sharply as does the straight line method. This method is used by many general contractors who arrive at an hourly or daily rental charge for every piece of equipment used on a contract. To follow through properly with such a system requires a broad knowledge of accounting practice. The straight line method is better adapted for average conditions.

Item 6, the annual interest cost charge, usually considers the rate of interest as 6 per cent. Allowance on this interest charge may be made for the interest that is depreciated yearly. This allowance may be figured by use of the formula which is computed through the process of arithmetical progression and which is as follows:

$$\frac{\text{N plus 1}}{\text{N}} \times \frac{\text{R}}{2}$$

N equals number of years at which the machine is depreciated.
R equals rate of interest.

Supposing the machine is to be written off the books in five years time and the interest on investment is charged at 6 per cent. N would then equal 5 and R would equal 6 per cent. The formula would then be

$$\frac{6}{5} \times \frac{0.06}{2}$$

which gives the result 0.036 or 3.6 per cent which is the figure that is to be used in the cost example cited here. On this basis the yearly interest charge for the example given would be $540 each year for 5 years for the value here used.

Item 7 is the allowance for maintenance and repairs. This is a figure that will vary with operating condi-

tions, with the class of operators or runners, and with the age of the machine. The figure 5 per cent which is used in the example is an arbitrary one, but is based on averages taken from a number of shovels working under extremely difficult conditions mostly in rock work. If the life of the machine is figured at 10 years, the repairs will be much heavier during the last five year period than during the first five-year period. It is sometimes customary to set up a maintenance or repair fund during the early life of the machine to cover its entire estimated or depreciated life in order to take care of the heavier cost as the age increases.

It is usually desirable to leave this maintenance figure flexible for changed conditions. This is especially true of contracting work as the machine may be on comparatively easy digging for a time and then later move on a hard job, such as rock handling. Accidents are also an intangible factor in this connection. Experience is the best measuring stick to use in governing this charge.

Item 8 covers total annual fixed charges. This will be a total of items 5, 6 and 7 inclusive and is the basis on which to figure the daily fixed charge or machine overhead rate.

Item 9 is daily fixed rates. This figure will be computed by dividing item 8, the total annual fixed charges, by the anticipated number of working days during the year. This is the machine's daily overhead rate.

Item 12 is extra help. Occasionally extra help will be required on the machine due to some particular conditions in the operation of the machine. This should not be charged against the machine unless it has to do with some contingency in actual operation entirely independent of any other job operation.

Item 13 covers labor overhead and superintendence. If there is no blanket figure applying to all of the job operations, the estimated cost of office help and superintendence in connection with the operation of the machine should be charged here. A liberal figure is 15 per cent of the machine labor charge.

Item 14 covers fuel. This item should include the actual cost of gasoline, coal and water, fuel oil or electric current delivered to the shovel.

Item 15 includes lubrication, oil and grease. This item should include only the cost of materials. The work of lubricating the machine is usually assigned to the helper or to extra help and a heading for such work is taken care of under the labor item.

Item 16 comprises total daily operating costs. This is a total of items 9, 10, 11, 12, 13, 14 and 15 and takes in all factors that are directly chargeable to the operation of the machine.

Item 17 covers costs which are not chargeable to the machine. This figure includes waiting for loading equipment more than the normal period figured in the original estimate, delays by blasting, delays caused by rain, and delays caused by crusher breakdown. Above are all delays for which the machine is not accountable and should be charged to the operation causing the delay if it is a tangible one, deducting the amount from the machine cost.

Item 18 is the actual daily operating cost. This is item 16, the total daily operating cost, less item 17, delays not chargeable to the machine and is the figure on which the yardage or other output unit cost should be based.

Item 20 is the machine cost per yard. Assuming that the machine put out 900 cubic yards per day at a cost of $52.90, the cost per yard would be 5.88 cents. The example and explanation given set forth the main factors to be considered in recording excavation machine costs. Occasional variations to take care of special conditions, arising in individual organizations will, of course, be necessary, but the above will serve as an outline on which to start.

INVESTMENT OR FIRST COST OF MACHINE—1¼ CUBIC YARD SHOVEL

1.	Cost of machine F.O.B. factory	$14,400.00
2.	Freight	300.00
3.	Expense of placing machine on initial location	300.00
4.	Total first cost	$15,000.00
	ANNUAL FIXED CHARGES	
5.	Depreciation or amortization rate	3,000.00
*6.	Annual interest charge at 6 per cent	900.00
7.	Allowance for maintenance and repairs based on 5% of original cost	750.00
8.	Total annual fixed charges	$4,650.00
	DAILY OPERATING COSTS	
9.	Fixed charges—based on working 200 days per year	23.25
10.	Labor—operator	12.00
11.	Labor—helper	5.00
12.	Labor—extra help	.....
13.	Labor—overhead and superintendence (based on plus 15% of machine labor cost)	2.55
14.	Fuel gasoline at 18 cents	9.00
15.	Lubrication—oil and grease	1.10
16.	Total daily operating cost	$52.90
17.	Less delays not chargeable to machine	.....
18.	Actual daily operating cost	$52.90
19.	Daily yardage output	900
20.	Machine cost per yard	0.0588

* See discussion of this item—interest averaged on depreciated values.

Reservoir Walls Poured in a Continuous 20-Hour Operation

THE plain circular reservoir shown below was constructed for the Grafton, W. Va., water works. It is located on a hill overlooking Grafton and the Tygart River. An unusual feature of the job was that the contractors, Cole Brothers Construction Co., Morgantown, W. Va., built an industrial railway on the top of the forms. This railway carried two hopper bottom cars from the mixer. These cars dropped the mixed concrete for the walls into the forms. By this plan the entire wall was poured in a continuous 20-hour operation and the floor was laid later. Enough vibration was produced by the loaded cars of concrete to bring about proper settling of the mixture in the forms. A uniformly smooth wall surface was produced without the usual spading of the concrete.

This job required 1,000 barrels of Alpha cement which was furnished by the Rowlesburg Grocery Co., of Rowlesburg, W. Va. John M. Rice, Pittsburgh, Pa., was the engineer. A 1:1¼:2½ concrete mixture was used.

The Completed Reservoir Built by Cole Brothers Construction Company, Morgantown, W. Va., for the Grafton, W. Va., Water Works

Foundation Problems on the Red River Bridge, Arkansas

By P. C. McGillivray

Construction Engineer, Keliher Construction Co., Little Rock, Ark.

OVER $500,000 is being spent on the new highway bridge over the Red River at Fulton, Ark., and $250,000 is to be spent on each of the two approaches. This makes this particular project one of the largest of recent years in Arkansas. On the west side the site is in low land and it is necessary to build about one-half mile of concrete trestle work on concrete pile foundations.

The bridge structure consists of five 185-foot concrete arch spans, four river piers and two abutment piers and nineteen 40-foot flat slab girder approach bents, seven on the east side and twelve on the west side, and one 80-foot girder span on each side at the abutment. During the construction of this reinforced concrete bridge the contractor met with considerable difficulty, the greatest being in the foundation work.

The foundations for the piers are all from 25 to 30 feet below the river bed and rest on a hard shale. Open coffer dams were used with timber wales and struts and 50-foot Carnegie high arch web Section M-106 steel sheet piling. The first set of timbers was floated into place and secured with four guide piles driven at the corners. Then the second and third sets were placed over the first in small sections, thus lowering the wales as more weight was added. When three sets of timbers had been placed, the steel sheeting was placed around the box forming the cofferdam.

The sheeting was driven with a 9B2 McKiernan-Terry steam hammer, by continuous night and day shifts. As the box went down additional courses of wales were set. Particular care was taken, however, not to leave over 6 feet of the sheeting unsupported below the timbers. When the pile had been driven 6 or 8 feet below the bottom set of wales, the driving was stopped and a one-yard clamshell bucket used to excavate inside the hole. In some cases the timbers would go down of their own weight during the excavation, but in others, it was necessary to drive them. When all the timbers were in place and lowered to a proper elevation, the final driving would begin on the sheeting.

Dewatering the Cofferdam

The sheeting was driven to a depth of 5 feet in the shale and then the work of dewatering started. Wheat and rice were placed in the interlocks of the sheeting and fine cinders were placed around the outside of the box at the interlocks. The cinders were by far the most successful in sealing the interlocks against leakage, although both methods were used throughout. When the work of sealing had progressed sufficiently to warrant dewatering, two No. 4 Emerson steam pumps were placed in the corners of the box and pumping started.

To facilitate the initial dewatering, a 6-inch gas-driven centrifugal pump was set up near the top of the cofferdam and operated until its suction length was reached. This speeded the work so that it was possible to dewater a hole, 36 x 36 x 30 feet in about 6 hours. One Emerson pump was left in the cofferdam during the construction of the pier to take care of the water that seeped into the box.

Concreting

The concrete material was batched at a plant about one-quarter of a mile from the job and hauled to the mixer in industrial cars. A Rex 28-S one-yard mixer was used mounted on a platform 25 feet above the ground. The wet mix was discharged into steel bottom-dump buckets and transported over the river tram on an industrial track and lowered into the hole by one of the stiff-leg derricks. At Pier No. 1 only one derrick was used during the pouring, but at the other piers, it was necessary to use two derricks, one to pass the bucket from the mixer to the cars and the other to lower the bucket into the hole. The piers are about 60 feet high and contain about 600 yards of concrete. The pouring, once begun, was rapidly completed, usually only one day intervening between pours.

Difficulties Encountered

The river piers were very successfully completed but the abutment pier on the east bank was the one which furnished many costly difficulties. After the sheeting had been set, and the hole excavated, it was found impossible to lower the wales more than a few feet below their original elevation. Weight boxes were set in the four corners of the cofferdam and two 7,000-pound concrete drop hammers used in an effort to lower the timbers. After considerable loss of time the attempt to lower the wales was abandoned and additional courses built in below as the excavation and dewatering permitted.

The ordinary methods used for pulling sheet piling on the river cofferdams were unsuccessful at the abutment. Several methods were tried but the only successful one was a No. 400 Vulcan pile extractor, suspended from a 40-foot A-frame with seven part lines and a Koehring crane. Using this method the piles were extracted, but only at a maximum rate of 13 per day, which proved rather expensive.

Progress

Steel centering, fabricated by the Virginia Bridge & Iron Co., is being used for false work for the arch rings. The centering was erected from the river tramways by a stiff-leg derrick and supported at either end by a bridge seat of piles driven against the piers. When the

first two spans have been poured, the centers will be floated on barges to the next span and re-erected in quarter sections.

Work has been under way on this project for eight months and during that time has progressed very satisfactorily. Four piers have been completed, two arch rings are ready to pour and the east approach is complete, except for the girders and roadway slab. The contract should be completed by the fall of 1929 and, according to the present outlook, will be finished on time. None of the highway approach work has been started, so it will be the summer of 1930 before the structure is completed and opened to traffic. The structure will be a toll bridge operated by the Arkansas State Highway Commission and is on the southern route to California.

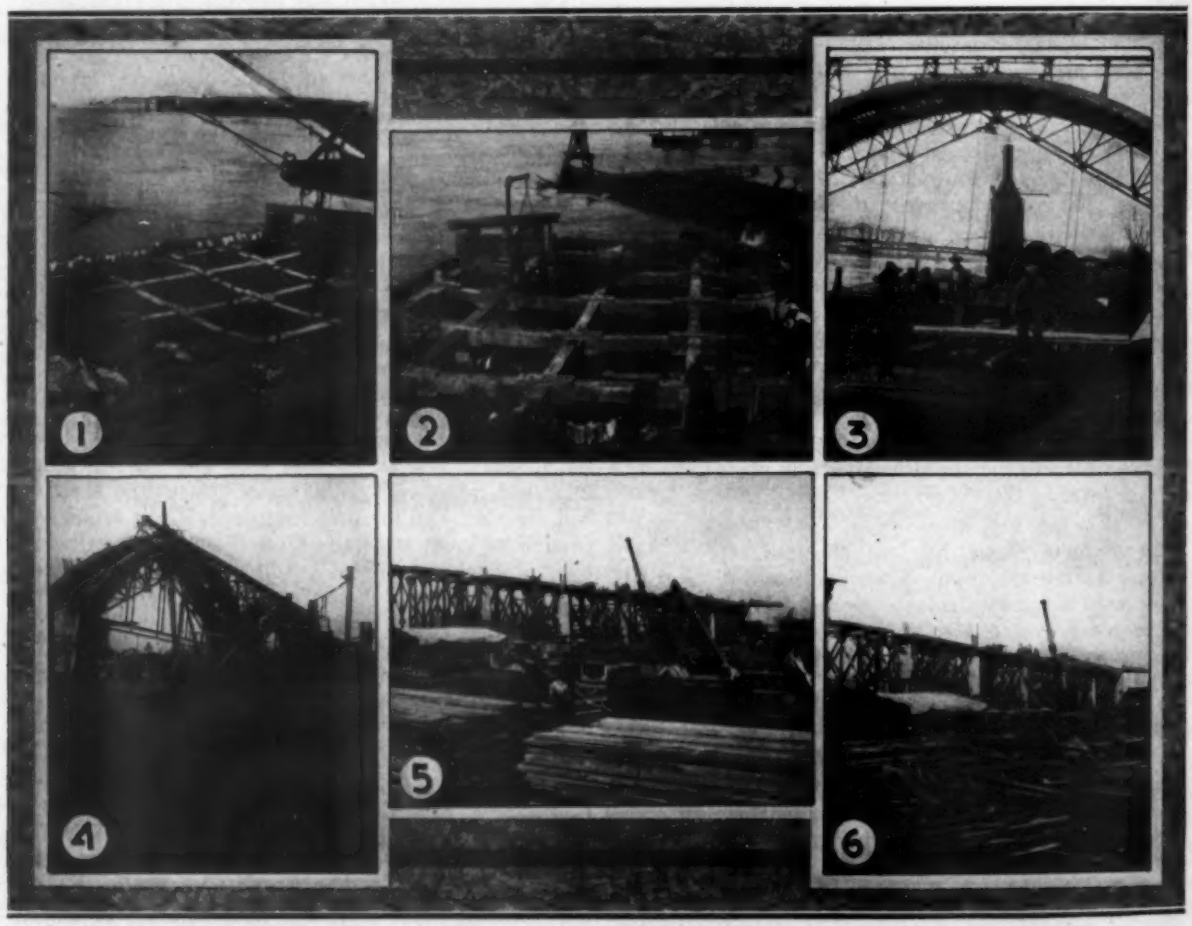
PERSONNEL

The structure was designed by Ira J. Hedrick, Inc., Hot Springs, Ark., and is being built under the direct supervision of J. S. Waldrep and R. L. Gay, Resident and Assistant Resident Engineers for Mr. Hedrick. The Keliher Construction Co., Little Rock, Ark., has the contract for all of the work, no subcontracts having been let. The author has acted in the capacity of construction engineer for the contractor throughout the progress of the work.

Avoid Damaging Telephone Wires and Posts

IT has come to our attention that telephone and electric light companies are now holding contractors responsible for damage done to their wires and posts. It is quite apparent that a considerable amount of damage and interruption to telephone and lighting service can be caused by the breaking of wires and the knocking down of posts through blasting operations, stripping operations and grading.

Contractors should be careful, as such damage is liable to be the basis of claim for reimbursement made by the company whose wires are damaged. Most of the difficulty can be avoided through greater care on the part of the contractors and through the state and county highway departments serving notice upon the public service companies, sufficiently in advance of construction, so that the necessary relocations of lines may be possible before actual construction begins.



CONSTRUCTION SCENES ON THE RED RIVER BRIDGE PROJECT AT FULTON, ARKANSAS

1. *Open cofferdam used for west abutment pier, showing arrangement of walls and struts and position of derrick. Note the sacks of cinders on the top set of walls. These were used for sealing the interlocks of the sheeting.* 2. *Another view of cofferdam showing position of Emerson pumps and clamshell bucket excavating.* 3. *Moving the derrick engine onto the 30 x 60-foot barge under its own power. This is one of the two barges being used for river work. Note the structural steel supporting the arch rings.* 4. *Two of the five 185-foot arch spans showing the derrick barge at Span 2 and the mixing and placing towers on the right. The two sets of steel centering shown will be used in all five spans.* 5. *Building panel forms for the girders and roadway slab. In the background are shown the East Approach columns and false work.* 6. *Gasoline crane erecting forms and false work. On the extreme right is the east retaining wall, 30 feet high, and of the counterfort type.*

Construction Plant and Methods for Hydro-Electric Installations

Detailed Report Prepared for Contractors and Engineers by a Committee of the Construction Division, American Society of Civil Engineers, Published in March, 1929, Proceedings

UCCESSFUL handling of hydro-electric installations depends largely on the proper solution of three problems, namely, 1, progress schedule; 2, water control, including cofferdams, and, 3, construction plant. The purpose of this report is to discuss these problems briefly and in a general way. The Committee which prepared this report consisted of Chairman W. L. Locke, Vice President, Stone & Webster, Inc., Lester V. Branch, Superintendent of Construction, Stone & Webster, Inc., Conowingo, Md., and Elbert C. Macy, Dwight P. Robinson & Co., New York City.

Field Men Important

More important than any of the problems outlined above are the field men of construction who plan and "plant" the job and who are responsible for turning blueprints into realities. This is true whether they operate under the name of contractor, superintendent, resident engineer, general manager, foreman or company executive.

Progress Schedule

Water conditions play such an important part on these operations and the necessity of taking full advantage of low water periods may result in such large savings that a carefully worked out progress schedule is very essential. Units of completed work per day in all the major items should be carefully computed and the work laid out in such a way as to take full advantage of water conditions. There are always certain vital dates which must be met. Otherwise the entire project may be delayed an entire season, adding greatly to the "interest during construction" item and reducing revenues from operation. Great care should be used in the selection of these dates.

The progress chart must work in very closely with "water control." After the chart has once been adopted, it should be carefully followed and no item of work allowed to get behind the schedule.

Water Control and Cofferdams

The basis of a hydro-electric installation is proper control of water. On most rivers in the United States either the Federal or the State government maintain gaging stations. While the period of time over which these stream flow records have been kept varies greatly, they are extremely important and should be studied with great care.

A composite graph of these records will show the flood frequency for any given month and will also determine the proper height to build the temporary diversion which generally consists of cofferdams. While the size and height of these will depend on the quantity of water to be handled, it is very rare that it is economical to construct them to such heights as to be positively sure that they will never be topped. Therefore, it is important to design and build them so they can take a considerable amount of overtopping and not be greatly disturbed. In general, these cofferdams are built of timber cribs filled with rock with a center clay puddle or a clay bank on the outside for water tightness or of cribs faced with planks only or steel sheeting. The bottoms of the planks are sealed to bed rock by placing a sack containing mixed sand and cement under each plank. These sacks are placed by a driver. They must be constructed so that they will not overtop or slide. None of the members should be strained to the point of crushing. While the cofferdam is a piece of temporary construction, it should never be considered as such, but built with the greatest care possible.

The selection and placing of the pumping plant are of utmost importance. The plant should always be in duplicate, as a breakdown would be most serious both in time and money. Wherever possible, the use of electric power is recommended; but if there is any possibility of disturbance to this source of power, steam auxiliaries should be at hand.

Camp

Hydro-electric developments are generally located away from centers of population, making it necessary to provide housing and food for the construction forces; and, as a part of the construction job, a village is necessary to house the operating personnel after the construction period is finished. It is recommended that the permanent village be planned and built at the start so that it can be used by the construction forces and avoid the expense otherwise necessary in providing temporary houses for these men.

Most states have laws governing housing and sanitation, which must be followed. The camp should be located near the work and should include a well-equipped hospital. During the operation of the camp, great care should be placed on cleanliness; and good, wholesome well-cooked food provided. No part of the work will pay better dividends than a well-planned, well-operated and spotless camp and hospital.

Power Supply

Whenever possible, electric power should be used and it must be free from interruption.

Transportation

Transportation is the keynote to all hydro-electric

installations. With large quantities of material to be handled in short spaces of time, it must be conceived and operated so that a breakdown is impossible. A careful estimate should be made of the tonnage to be handled; this should be divided into "external" and "internal" transportation, external being all materials which come from an outside source, such as cement, steel machinery, foodstuffs, etc., and internal being that which originates at the site, such as excavated materials, mixed concrete and other construction materials.

The plan should be as simple and, at the same time, as flexible as possible. The tracks and equipment should be well maintained so as to avoid derailments, and, if the operation is of considerable magnitude, it should follow railroad practice insofar as operation is concerned. Very gratifying results are now being obtained by the use of gasoline locomotives in place of steam. On small jobs, trucking is often advisable; and in rough mountainous country inclines are often used.

EXCAVATION

Consideration should be given to the use of gasoline engines on construction equipment. Recent rapid strides in gas-engine practice have produced some very dependable machines which show decided economies over steam. A study should be made of each piece of equipment to determine its value on the particular operation on which it will be used.

The use of crawler shovels is strongly recommended. Consideration must also be given to crawler draglines and the various sluicing methods. Attention is also called to the size of the air-compressor plant. An almost universal error on construction jobs is a deficiency of air.

CONCRETE PLANT

Concrete is one of the large items of expense on most hydro-electric developments. This is true even if the water for the project is controlled by earthen dams and the head is developed by canals of various forms, for there is still considerable concrete to be placed in spillways, intakes, power-house substructures, and other foundations.

The plant required to place concrete of the required density and strength in these various structures depends on many elements which require skillful evaluation of benefits and costs.

LOCATION OF MIXING PLANTS

While the location of structures often renders it impracticable to use a central mixing plant, such a plant will generally show advantages in cost of handling materials and proper control of mixtures. The central mixing plant should be located on the natural route of travel of the concrete materials entering the work on their way to the structure. Topographic features should be taken advantage of to keep cost of road work to and from the plant to a minimum consistent with uninterrupted traffic on other operations.

If access to the site is up the valley of the stream being developed, the site of the mixing plant is usually at low elevation, near the stream, and below the hydro-electric plant. If the site is reached at a high level at either end of the work, the advantage of a side-hill location for the plant, permitting the feeding of the mixers by gravity, should be considered. Where concrete is handled from the mixer by train or trucks it is usually desirable to locate the mixing plant and attendant material storage far enough from the structure to avoid the congestion usually found in connection with the foundation excavations, form work, and other operations.

CAPACITY OF PLANT

Progress schedules should be prepared for each of the major concrete features. A combination of these schedules will give the maximum plant requirements. As the peak requirements usually occur when foundations for the dam or power house have been unwatered and excavated, the plant should have a capacity sufficient to complete the structures quickly to a height above probable damage by floods.

A plant, with 1 cubic yard of mixer capacity for each 4,000 to 5,000 cubic yards of concrete to be placed per month of active concrete work will have a reserve capacity, under continuous operation, sufficient to place concrete in such critical periods at the required speed. In general, it is desirable in large plants to have duplicate units rather than a single mixer unit of large size. This size of unit depends on the size of scheduled pours and methods of placing, 1 and 2-cubic yard mixers being the size customarily used.

In a few cases 4-cubic yard mixers have been used. This is only practicable where the concrete is to be placed in large masses, but, in such instances, it may be economical since the first cost and installation of derrick or crane equipment for handling buckets containing 4 cubic yards of concrete is very little greater than the handling of 2-cubic yard buckets. However, the disadvantages of the large units are that other mixers and equipment must be provided for placing the many smaller masses of concrete and this results in duplication of the plant. Also, concrete forms must be built stronger to withstand the shock of dumping the greater mass of concrete, and unless the concrete has great workability, additional labor is required in the forms to place it properly.

MIXING PLANT ACCESSORIES

A plant designed for proportioning materials so as to obtain uniform mixture will pay well in savings in the cement content of the concrete and in handling costs by maintaining the workability of the concrete. For this purpose the use of automatic measuring equipment is almost essential for the usual mixing-plant labor cannot be developed to the efficiency of available measuring or weighing batchers. The measurement of sand by weighing or volume measurement in water is desirable.

Where the plant can be laid out to use bulk cement there are a number of desirable features to be obtained by its use; principally lower first cost, no bag loss, and greater flexibility in changing the cement content of the concrete without changing the measuring apparatus for aggregates.

Especially on projects of considerable magnitude the saving in the cost of the expensive cement by careful study of available aggregates and design of workable mixtures may indicate the advisability of separating the aggregate into more than the customary fine and coarse sizes. The cost of providing plant facilities for handling and proportioning two or more sizes of coarse aggregate is considerable, and while

often uneconomical, should receive careful consideration in designing the plant.

The use of admixtures is sometimes desirable to increase the workability of the concrete. This usually is an expensive procedure, unless the mixing plant has been laid out to permit the handling of such material, hence consideration should be given this subject before constructing the plant.

Concrete Placing Equipment

The principal methods used for handling the mixed concrete to the forms are:

1. In hopper cars, operating on tracks passing directly over the forms, and dumping direct, or through short chutes.
2. In buckets to be handled by derricks or cranes.
3. In buckets to be handled by cableways.
4. By chuting.
5. By belt conveyors.
6. Various combinations of these methods.

For long dams or scattered work, distribution by cars is quite general. The tracks may be placed on the ground or on a construction bridge on the downstream side of the dam. While masonry and timber construction bridges have been used, a steel structure is usually the best.

The derrick equipment may be either stiff-leg or guy derricks. For high structures there is considerable advantage in the use of guy derricks, in that they may be located either on the face of the dam or between penstocks where space for a stiff-leg derrick is not available.

In a number of cases the construction bridge has also been designed to support gantry cranes or traveling stiff-leg derricks which were used to place the concrete and handle forms and other material. At the Conowingo Dam, on the Susquehanna River, concrete hoist towers were attached to the traveling derrick towers, so that the concrete could be elevated and placed through very short runs of chutes which were supported entirely by the derrick traveler.

Handling concrete by cableways is slow and advisable only for comparatively small quantities. In the placing of concrete by belt conveyor the difficulty of depositing in all sections of a form is practically identical with the difficulty in this regard experienced by the chuting method.

Chuting plants show low placing cost in high structures and on structures in congested locations where trackage is difficult to establish. The pronounced prejudice now found in some quarters against chuting concrete in hydraulic structures is due more to failure of the chuting equipment manufacturers and personnel of construction organizations properly to design and use chuting equipment than to inherent faults of the system.

Concrete can be used in massive structures with a lower water-cement ratio and less cement per cubic yard than in reinforced concrete buildings. Chuting equipment was largely designed for building work, with hopper gates and other features of the equipment not adapted to the less easily worked concrete of low cement content.

In laying out chuting plants construction men have failed to see that concrete could be deposited from the chutes in all parts of the forms while maintaining a proper slope of the chutes. With short runs of chutes arranged to discharge over all areas of a form, good concrete can be placed at low cost.

Power Station Building

The power station buildings on hydro-electric installations are generally structural steel buildings with walls of either concrete or brick, depending on local conditions. As time is generally the essence of a hydro-electric development a structural steel building generally lends itself better to this type of work, as it is highly desirable to have the use of the power house crane as early as possible so that machinery erection can proceed. This can generally be accomplished more quickly with a structural steel building than one of reinforced concrete.

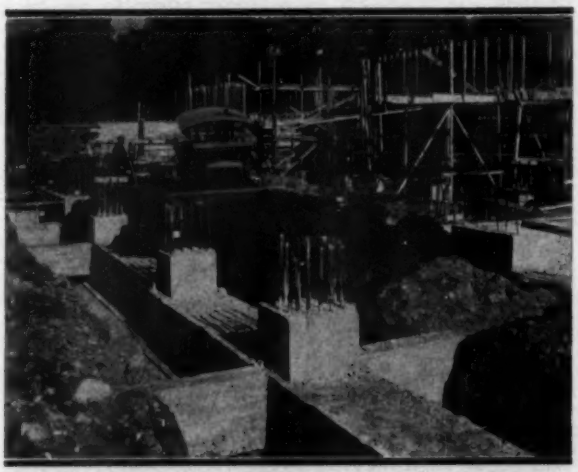
Machinery Installation

The machinery erection program is closely allied with the construction of the power-house structure itself. Consequently, in planning the program, it is necessary to work out a detailed schedule that will minimize the interference between the various job activities and permit rapid progress on the construction of the whole power station. On this account the erection of each unit is broadly divided into stages as follows:

1. Draft tube and discharge ring
2. Speed ring, scroll case and pit liner
3. Runner and wheel case
4. Generator, stator and rotor
5. Governor, generator bearings and auxiliaries

These schedules are carefully dovetailed into the construction schedule of the power station structure, and particular care is taken to avoid interference in the erection of adjacent units.

Tractors Prove Useful In Many Ways



BUILDING CONTRACTORS CAN PROFITABLY USE TRACTORS ON MANY JOBS WHERE THEY WILL PAY FOR THEMSELVES BY REPLACING THE PICK AND SHOVEL GANG

This Caterpillar tractor owned by Ariss Knapp Co., Oakland, Calif., and equipped with a McMillan hydraulic bulldozer, was used for filling in around the foundation of an addition to the University of California at Berkeley. One man with this Caterpillar Thirty did more work than a gang of one hundred men could have handled

Grading in New Mexico at $29,000 a Mile

By F. E. Barlow

Project Engineer, New Mexico State Highway Department

PROBABLY one of the toughest and one of the most costly jobs per mile ever constructed in the State of New Mexico is now being built and will cost when completed approximately $29,300 per mile for grading and structures alone. This job is known as New Mexico Federal Aid Project No. 151-A, Bernalillo County, and is located east of the city of Albuquerque in Tijeras Canyon, beginning at the end of the present pavement and extending for a distance of approximately 8.8 miles. This job is on what is designated as Federal Aid Route 13 and, as such, is classed as a secondary road. It is also on the Federal system of highways and is designated as New Mexico No. 470.

The local traffic whch uses this route is that between Albuquerque on the west and the town of Moriarity, Estancia and Willard in the Estancia Valley, on the east. This valley is a great agricultural spot and is known for its large acreage of beans. It also serves as an opening to the Loop Road which turns north into the Sandia Mountains at about the center of the job. This is a summer resort for the city of Albuquerque and is also in the National Forest. There is considerable tourist travel both ways through this canyon. Westbound tourists are in a hurry to get to California and eastbound tourists are in a bigger hurry to get back home.

This particular section of road was located during the winter and spring of 1927-28. After the necessary routine of inspection by the State Highway officials and representatives of the Bureau of Public Roads, the job was advertised for construction in July, 1928, and bids were opened July 25, eleven bids being received. The original bid called for a project approximately 15.1 miles long, but this had to be shortened because the bids exceeded the estimate by too wide a margin. On October 4, 1928, the T. J. Tobin Construction Co., of Madison, S. D., was awarded the contract.

Grading Started Early in October

This contract called for the grading and drainage structures only. Undoubtedly there will be another contract called for at the completion of this work which will place some kind of a permanent top on the grade. The top will probably be concrete or oil-processed gravel. Grading work started on October 10 and a few days later excavation for structures followed. Up to February 1, 1929, there had been no shut-downs on account of inclement weather, nor is it expected that there will be any, other than perhaps a day or so at a time as the climate at this location is ideal for year around construction work.

The job is practically a relocation of an existing road. The new location, however, is much farther up on the hillside in some places than the old road and only at a very few places is the present route followed and these for very short distances. The maximum grade is 6 per cent as allowed by the U. S. Bureau of Public Roads. Of the alignment 3.14 miles or 35.6 per cent of the entire project is on simple curvature which consists of 364 degrees, 13 minutes to the right and 392 degrees, 59 minutes to the left. The greatest degree of curvature is 10 degrees and the smallest is 2 degrees with the 4-degree curve predominating. This curvature is in over 26 curves giving an average length of 637.3 feet per curve.

Handling Traffic

Traffic is maintained at the necessary places by means of suitable detours which have to be kept passable at all times by the contractor.

Drainage Structures

Owing to the topography of the country through which this job passes, practically all of the water is handled by cross drainage and the run-off is very rapid. Consequently the structures had to be large enough to take care of a considerable volume of water in a very short time. They must also be of a permanent type for the road to follow. Therefore, all culverts are reinforced steel and concrete girder type bridges.. The culverts range in size and opening from 3 x 1½ feet to 10 x 6 feet. The lengths are from a minimum of 32 feet to a maximum of 124 feet. All bridges are 40 feet in width. There are about 100 box culverts and 5 bridges to the 8.8 miles. The bridge girders are set on concrete abutments which are carried well below probable scour and erosion.

Bridge excavation is carried on with a rotary fresno hauled by a Caterpillar Thirty tractor as far down as possible and then is completed with hand labor and a team and slip scraper. Form work and steel placing for these structures is done by one crew. When concrete is ready to be placed the box culvert crew is taken to the site where the forms are filled. In box culvert work there are from 3 to 5 crews excavating, each crew ranging from 2 men and a team with slip scraper to 4 or 5 men hand shoveling the dirt and rock. Some blasting is necessary in this work.

Concreting

There are one to three crews forming and placing steel, consisting of from 3 to 5 men for each crew, and then there is a crew of about 12 men pouring and finishing the concrete. A small crew of 4 men is kept busy most of the time cutting and bending the

steel as most of the steel is being bought to mill lengths and cut and bent on the job.

Actual pouring of the concrete began in the first of November during which month there was poured one complete culvert box per working day. This was done with a Rex one-sack mixer, and a Wonder mixer of like capacity. Up to February 1, approximately 40 boxes and one bridge has been completed.

Class A concrete is used throughout with a mix of 1:1.9:3.9 and a slump of 4 to 5 inches. This concrete is giving a 7-day test of about 1,500 pounds per square inch compression and a 28-day test of about 2,600 pounds. Both results are well within the State requirements for this class of material.

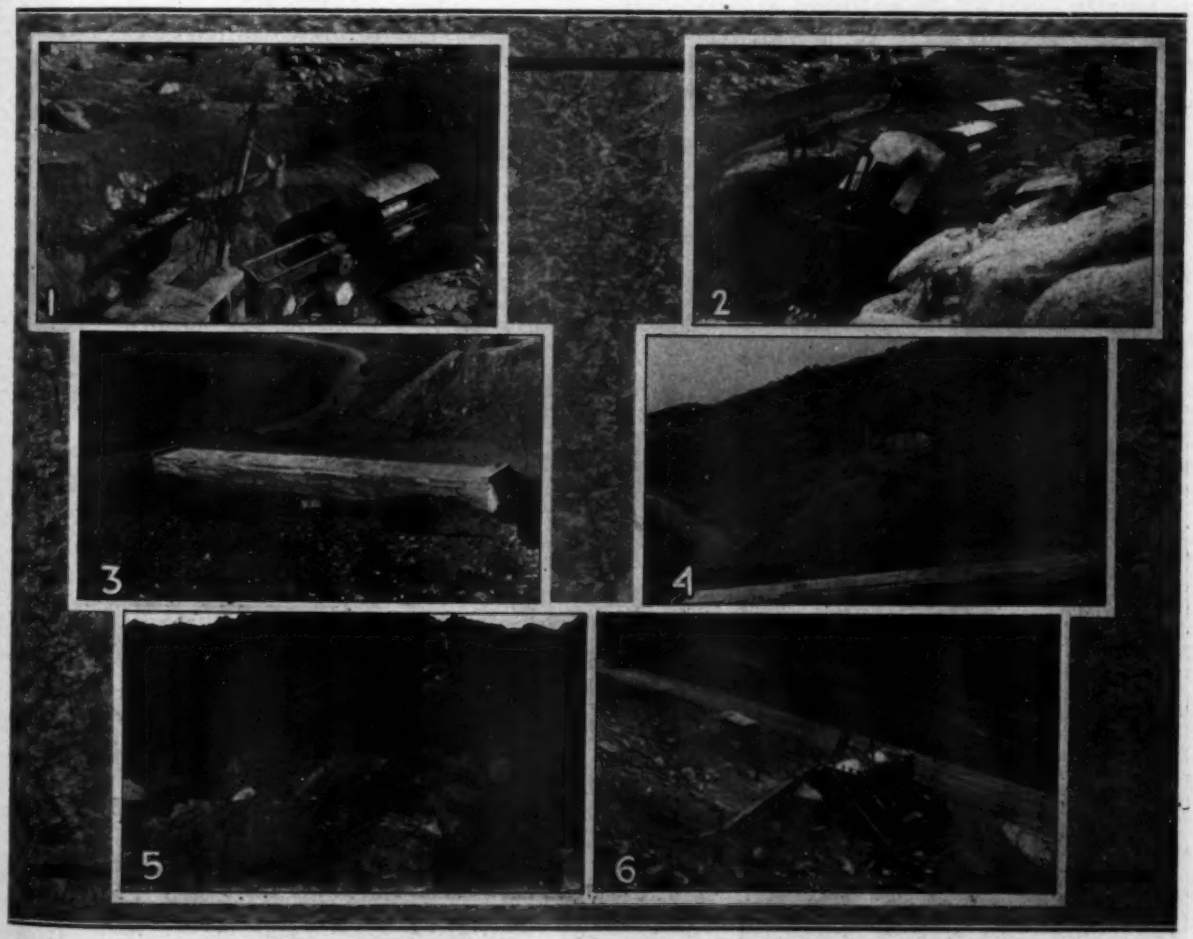
AGGREGATE

Coarse aggregate is being shot from a limestone cliff along the roadside very nearly at the center of the job. A 9 x 20-inch Cedar Rapids jaw crusher, powered by a Caterpillar Thirty tractor, is used to reduce the aggregate to the specified size. Sand is purchased from a local commercial pit. Ideal Brand cement from a Colorado plant furnished through the local dealer is being used. All reinforcing steel is being furnished direct from the mill of the Colorado Fuel & Iron Co., of Pueblo. All materials used in the making of the concrete have to pass the standard tests of the State Highway Department Bureau of Tests.

All materials are hauled to each structure site and there mixed and placed. If the weather necessitates, the concrete is heated before being placed and a temperature of about 80 degrees Fahrenheit is maintained. Rigid inspection and care is taken on this phase of the work.

HEAVY EQUIPMENT USED ON GRADING

Grading is being done in two 10-hour shifts with a 1¼-cubic-yard Osgood gas shovel loading into 4-cubic-yard Mack trucks which place the excavated material in the embankment. Since the topography of the country is very mountainous, the grade changes rapidly from cut to fill. The shovel starts into one of these cuts by sidecasting the material in the fill as far as possible and then loads into the trucks which place the material into the embankment and carry the grade at an approximate elevation by end dumping.



PROGRESS PICTURES FROM FEDERAL AID PROJECT 151-A EAST OF ALBUQUERQUE, N. M.

1. Excavating for a bridge abutment footing with a Northwest gas shovel and using LaPlant-Choate dump trailers. The footing was excavated 18 feet below the flow line of the arroyo. 2. Two Caterpillar Sixties pulling the shovel out after excavation was completed. 3. An 8- x 4-foot concrete culvert 98 feet long to be covered by a 23-foot fill. 4. A 1¼-yard Osgood gas shovel working in a side hill cut loading Mack trucks. The embankment at the end of the dump will be 32 feet high when complete. 5. Mack truck dumping an embankment. Note the rocky and boulder formation of the embankment. This is to be covered with a fine material to fill the voids. 6. Set-up of the rock crushing plant for concrete aggregate

Practically all of the excavation so far has been made in solid rock, drilling of which is being done with a large size Ingersoll-Rand portable compressor furnishing air for three Jackhamers. Cuts in solid rock are carried about 8 inches below profile grade and then brought back up to finished grade with a layer of selected dirt borrow. This procedure is also carried out on fill made of this rock material.

The largest shot set off to date contained approximately 7,000 pounds or 3 1/3 tons of 40 per cent dynamite. This blast was spread out over an area about 500 feet long and an average width of 40 feet.

A fresno outfit consisting of six 4-up teams and a 4-up plow does the necessary light grading and finishing along with more or less hand work in the ditches and box slopes.

LaPlant-Choate 6-cubic-yard dump trailers hauled by Caterpillar Sixty tractors were tried out at the beginning of the job, but, on account of the large boulders and pieces of rock encountered, it made the going so rough that it was decided to abandon them temporarily.

Cuts up to 40 feet in depth have been made and fills of like height are not uncommon on the job. All excavation is "unclassified" and was bid in as such. What per cent of the whole job is solid rock is difficult to determine at this time, nor will it be possible to come to any reasonable figure until the completion of the entire job.

The standard width of the roadway from shoulder to shoulder is 26 feet on fill up to 3 feet in height at the shoulder line with slopes of 3 to 1. On fills 3 feet or over at the shoulder this width is increased 1½ feet and the slope is that which the material will take, varying from 1.2 to 1½ to 1. On all curves of 10 degrees or over, there is an additional 3 feet added on the inside of the curve. Super-elevation of 0.55-foot on curves up to 3 degrees to 2.7 feet on 10-degrees curves or more is the standard practice.

All dangerously high fills are to be amply protected with a standard make of guard fence, supported on 8 x 8-inch posts placed on 10-foot centers.

QUANTITIES

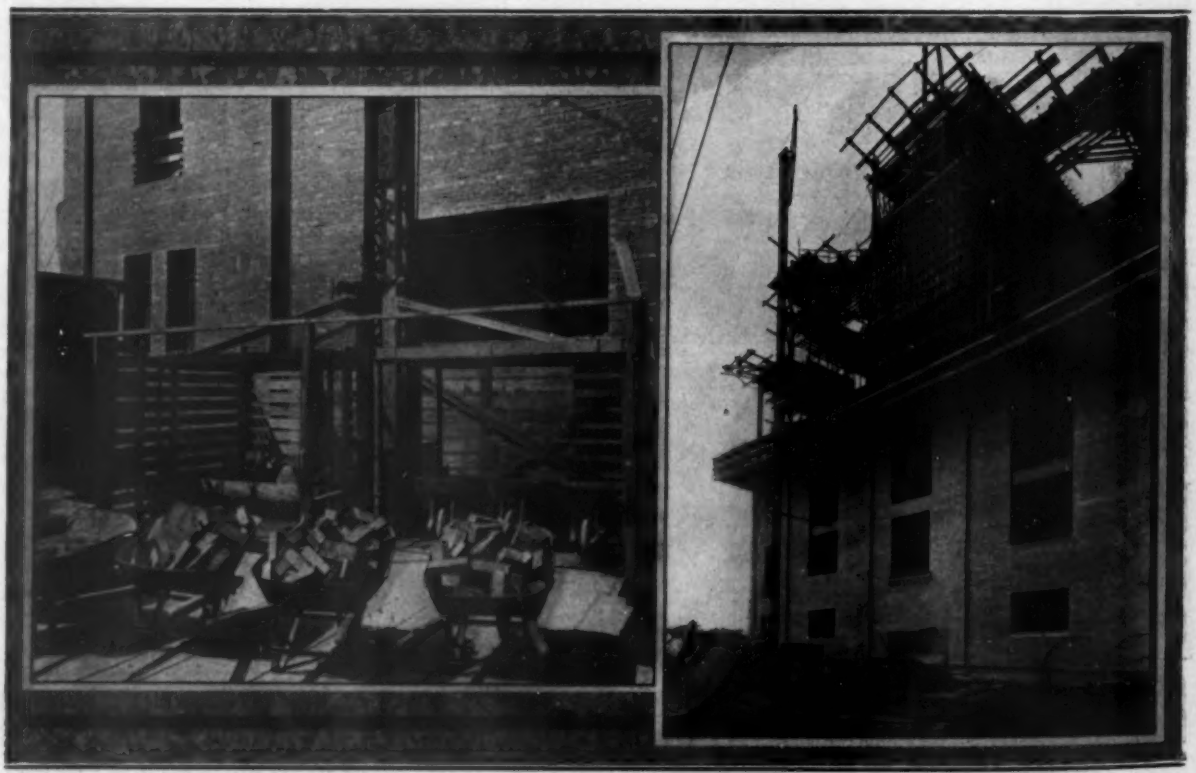
Following are the major items and the quantities of each as estimated:

Excavation, unclassified	164,663	cubic yards
Borrow	112,308	cubic yards
Overhaul	62,443	station yards
Class A concrete	3,516	cubic yards
Reinforcing steel	446,250	pounds

The contract time for this job is 300 working days but at the present rate of progress the indications are that it will be completed in considerably less time than the contract allowed for, probably well within 200 working days.

PERSONNEL

This project is in charge of W. C. Davidson as State Highway Engineer and Frank Kimball as District Highway Engineer with the writer as Project Engineer. T. J. Tobin, contractor, has been personally on the job most of the time with Harry Young as his superintendent in charge of grading and Henry Thygerson in direct field charge of all concrete work for the contractor.



SIMPLE MATERIAL HANDLING SCHEME ON A POWER STATION JOB AT BUFFALO, N. Y.

At left, both material elevators at ground level showing them loaded with three wheelbarrows in each cage. At right, the 120-foot Insley mast with one cage at the hanging scaffold, also showing the steel boom near the top of the mast for handling steel and lumber

Mixing Plants and the Transportation of Ready-Mixed Concrete

Important New Industry Rapidly Being Developed Within the Construction Field By Various Interests

IT is estimated that at the present time over six and a half billion dollars are being expended annually for building construction and over one billion dollars for road construction. An annual building program of this size requires a vast amount of concrete and the transportation of millions of tons of concrete materials. Concrete is mixed either on the site of the work or at a central mixing plant.

Transportation

Four methods are commonly used in the transportation of concrete materials.

Delivery of materials to storage piles. This is the method that has generally been used for building construction and provides for delivery to storage piles close to the mixer at the site of the work. The ordinary standard dump truck is used for this type of delivery.

Batch hauling. This method is usually used on concrete road construction. A batch truck carries one or more dry batches, each containing the concrete aggregates in their proper proportions loaded at a central proportioning plant. Any standard dump truck can be used for batch hauling with the addition of swinging partitions to separate the batches.

Concrete mixers on truck chassis. Mixers have been designed for mounting on a truck chassis, such as the Barrymore concrete mixer and the Transit concrete mixer. The aggregates are dumped into the mixer in their proper proportions, the dry batch hauled to the job and the concrete mixed on the site of the work. Owners of such units are manufacturers of concrete and sell their product to contractors and other users of concrete.

Ready-mixed concrete. The fourth method has been used to some extent for several years, but during the last year there has been a very considerable increase in the number of ready-mixed concrete plants. The experimental stage has been passed and indications are that during the next year this increase will be considerably greater and there will be a far greater use of motor trucks in this field. At the present time there are approximately one hundred ready-mixed plants in operation in the country.

Ready-mixed Plants

The operation of ready-mixed plants has brought out a number of advantages which factory production has over hand work and a large permanent plant has over several small temporary field plants. Materials can be handled by machinery from the time they leave the cars until they are delivered to the trucks as mixed concrete.

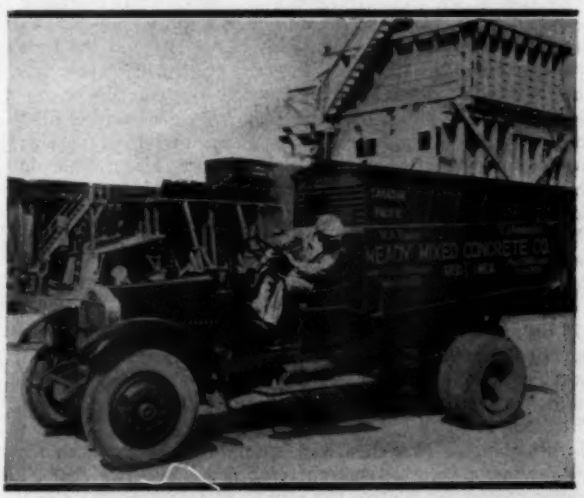
The amount of hand labor and the number of times the materials must be handled is decreased.

Measurement of materials and mixer operations are handled by a few men for several construction projects which otherwise would require several mixers and several large mixer crews. These operators become more skillful and capable of producing a better and more uniform quality of concrete than the average field operator. A properly equipped central plant is generally capable of measuring materials more accurately and obtaining more uniform proportions than field plants. Other advantages of the central plant are the elimination of the expense of moving mixing equipment from job to job, the reduction in labor required and the prevention of the waste of cement aggregate and sacks common to field work.

Progressive material dealers are recognizing the possibility for the sale of ready-mixed concrete and there will continue to be a considerable growth throughout the country in the number of ready-mixed plants.

Truck Equipment

Transportation has been one of the major obstacles in ready-mixed plants. Regular schedules of deliveries must be maintained to a job which requires ample and dependable trucks. Concrete has a tendency to segregate when hauled in trucks, the water and fine materials floating to the top and the sand and coarse materials compacting on the bottom. This has been



One of a Fleet of Thirty-two 2½-ton White Trucks Hauling Ready-Mixed Concrete for the Ready-Mixed Concrete Company, Kansas City, Mo.

overcome to some extent by the use of stiffer mixes with less water or the application of certain chemicals. Considerable difficulty has also been experienced with the concrete compacting and sticking to the sides of the body, making dumping difficult.

Several types of bodies have been built for hauling ready-mixed concrete. There is the bath-tub type body of the Wood Hydraulic Hoist & Body Co., the Tru-Batch body of the Avril Tru-Batch Co., the agitator body of the Blaw-Knox Co., a special body made by C. O. Bartlett & Snow Co., and others. There have been some installations with high lift hoists which permit chuting of the concrete when required for pouring directly into concrete forms to a height approximately 8 or 9 feet above the ground or of dumping into containers for serving the wheelbarrow crew. Pneumatic tires are generally preferred because there is less tendency for the concrete to compact.

READY-MIXED CONCRETE IN KANSAS CITY

The Ready-Mixed Concrete Co., of Kansas City, has one of the best equipped ready-mixed plants and is of the two-mixer type. The transportation of concrete is handled by 27 White trucks owned by the company and 12 other similer units owned by a hauling contractor. These units are 145-inch wheelbase, equipped with bodies built locally of the bath-tub type. The latest additions to the fleet have a chute in the tail gate. They haul 2 yards of ready-mixed concrete. During 1928, their sales exceeded 100,000 cubic yards of ready-mixed concrete.

Handling Asphalt Filler in Bulk for Brick Paving

A BRICK pavement was recently completed in Flint, Mich., on North Saginaw Street, with a pavement 74 feet wide between curbs. The street is paved with an entire new brick surface for a portion of the distance and with new 27-foot strips outside of the street railway tracks space for the balance. In all, it totals around 60,000 yards, according to H. C. McClure, City Engineer, Flint, Mich., who presented a paper describing it at the Twenty-Third Annual Meeting of the National Paving Brick Manufacturers Association. The specifications called for an asphalt joint filler to comply with the state highway specifications for this product.

Because of the location of the job, it was deemed advisable to eliminate as much interference on the street as possible and to reduce complaints and nuisances on the street. The item which was thought likely to cause the greatest objection was that of heating the filler in small street kettles. The suggestion was made to the contractor that, instead of getting filler in drums and using small street kettles and hand pouring methods as usually employed, he secure his asphalt in insulated tank cars, ship the cars directly to the engineering department siding where plant steam would be available and then use a distributor truck for applying the filler. This suggestion was adopted and it resulted in more than the usual degree of success.

The asphalt reached the plant siding at a temperature of 175 degrees Fahrenheit or above and required only about four hours of plant steaming to make pumping into the distributor possible. The distributor carried a jacketed pump operated from a power take-off which not only fills the tanks, but circulates or discharges the asphalt as well by means of a three-way valve control. The distributor also carries an air compressor, a portable coal oil torch flame, and two coal oil burner nozzles for heating the asphalt in transit to the street or maintaining the asphalt at any desired temperature.

An ordinary fan-shaped nozzle was used for applying the asphalt direct to the street, the three-way valve being opened just a sufficient amount to give the desired quantity for the work at hand. Three men on the squeegees were all that were required for the street end of the work, the nozzle man and truck driver being furnished with the distributor outfit. When the brick surface was laid far enough in advance, it was possible to pour easily three full tanks of 700 gallons each in a single day and cover in excess of 2,000 square yards of surface. This pouring operation was so fast that the outfit was unable to operate for continued run of full days, but was required to cut down to two tanks per day quite frequently.

Aside from the advantages to the workmen and to the residents, it is believed that the advantage of the job was without question a decided one. The material was maintained within a temperature range of less than 25 degrees, regardless of outside temperature and regardless of the amount of material in the tank and it was absolutely uniform in every physical characteristic. By applying directly at the desired point and following immediately with the squeegee, an excessive amount was not left on the surface, yet all joints were completely filled.

During the progress of the job summer showers occurred, but these caused no inconvenience whatever because the pouring operation could be stopped instantly and, on occasions when the rain continued the distributor was simply drawn back to the yard and the remaining portion in the tank pumped back into the tank car. With this extreme flexibility of operation, the pouring could be continued at various points along the job with only a few minutes lost time in moving the truck ahead and a half hour's pouring in one portion of the work required no special set up and could just as easily be taken care of as a full day's pouring at another section of the job.

It is believed that the work as outlined at the start proved to be unusually successful from the contractor's, city's and residents' viewpoint. There was no more expense in taking care of the work and the absolute uniformity, flexibility and dependability of this portion of the job recommends itself very favorably for work of this character.

Design and Control of Concrete Mixtures

THE fundamental requirements, processes and specifications for the design and control of concrete are described in a 72-page booklet "Design and Control of Concrete Mixtures," which is published by the Portland Cement Association, 33 West Grand Avenue, Chicago, Ill.

According to the foreword of this booklet, the three fundamental considerations which should determine the design of concrete structures are strength, durability and economy. Fortunately the factors which govern the strength of concrete affect with equal importance the resistance to percolation of water and to weathering. Once this fact is pointed out, the vast experimental data on the strength of concrete are available for use in the solution of the problems of making durable structures.

The application of the water-cement ratio principle gives a very easy method of designing concrete mixtures for definite qualities. Its simplicity recommends it. Involved calculations are not necessary. In this booklet, which is a revision of an earlier publication carrying the same title, the proportioning of mixtures by trial is recommended. Several years of practical application have demonstrated this method to be most suitable for all conditions. A general treatment of the factors essential to the economic production of concrete of proper strength and durability is included. Particular emphasis is placed on the selection of materials, the mixing and placing of concrete, and protection during curing, also upon the importance of proper workability in the design of the mixture.

Specifications for plain and reinforced concrete are given, as well as the specifications and tests of the American Society for Testing Materials. Copies of this booklet are available gratis to those writing to the Portland Cement Association and mentioning CONTRACTORS AND ENGINEERS MONTHLY.

Foundations in Frozen Ground

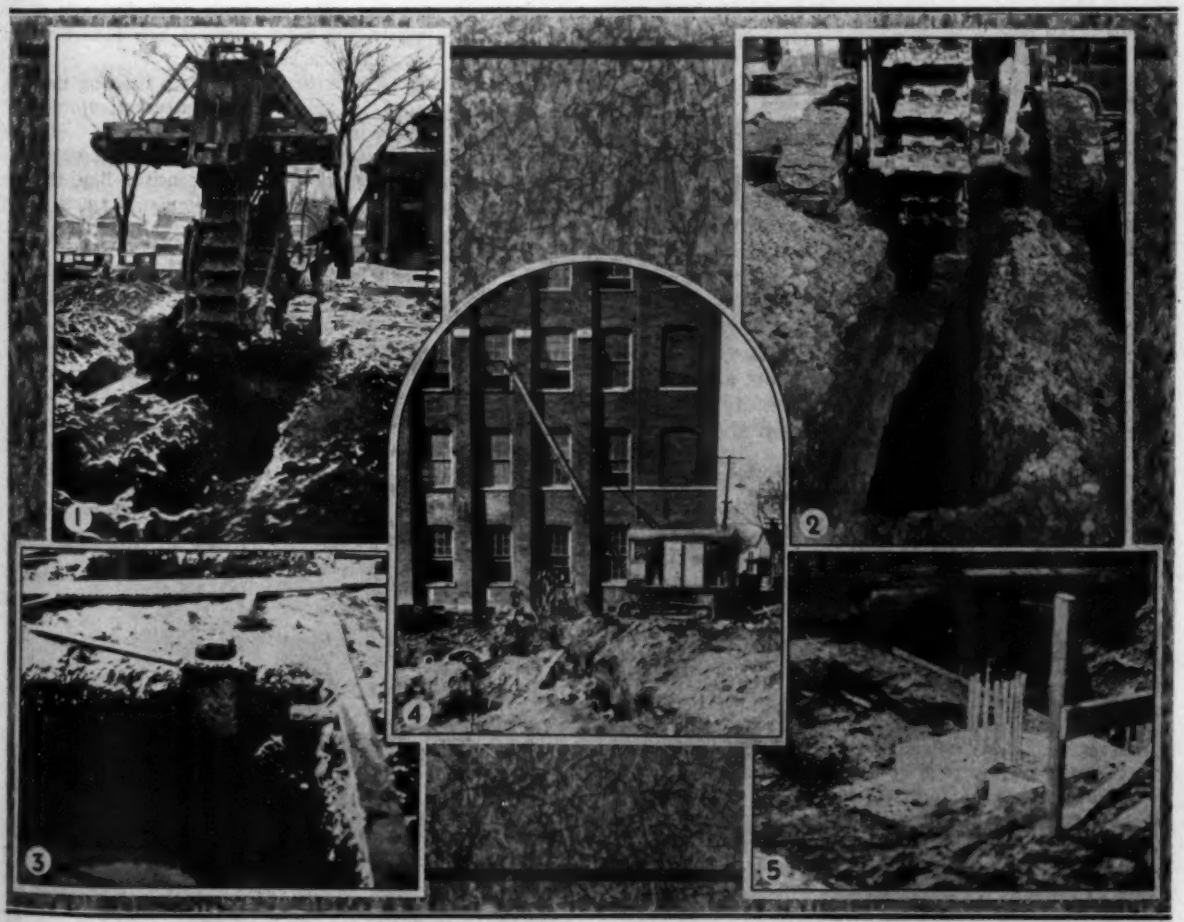
By Nils G. Olsson

President, the Olsson Co., Inc., Contractors, Aurora, Ill.

A NEW concrete and steel structure is being built for the Independent Pneumatic Tool Co., at Aurora, Ill. The work on the foundation occupied a part of the winter and brought up an excavation problem of not mean proportions which the contractor was called upon to solve. In order to eliminate entirely the necessity of a shovel in excavating for the pier foundations through the frozen ground, the Olsson Co., decided to use a vertical boom ditcher entirely.

Ordinarily, it would have been necessary to employ a shovel to excavate the entire site. This would have necessitated backfilling after the forms for the piers were set and poured, meaning that all the material around the piers would have to be handled twice. This would also mean, of course, that this material would not be nearly as solid as it was before excavating.

A Barber-Greene vertical boom ditcher which cuts straight down and can turn absolutely square corners, as well as dig the excavation with a perpendicular side, was rented. The operator cut a ditch 6 feet deep and 10 feet 4 inches long, then turned 90 degrees and dug 10 feet 4 inches, turned again and again until a rectangle was cut with the outside ditch dimensions 10 feet 4 inches by 10 feet 4 inches or the required size for one typical pier excavation. The ditcher was then through with that pier excavation and sent on to the next. A Speeder crane with clamshell bucket went after the dirt left in the center, measuring 8 feet 4 inches by 8 feet 4 inches by 6 feet deep, and, even though the material was frozen for two feet, it was easy for the clamshell to handle. The bucket could easily get a



DIGGING AND CONCRETING THE FOUNDATIONS WITHOUT FOOTING FORMS

1. The Barber-Greene ditcher with the boom raised just after completing one side of the pier excavation in frozen ground. 2. A close-up showing the vertical outline walls. 3. A cut through an old house foundation. The Speeder crane excavating the center chunk at one of the cantilever pier foundations after the ditcher had cut the vertical outline walls. 5. A completed cantilever pier poured up to the base of the columns

bite and remove the chunk in a few operations, leaving an absolutely clean, square, straight, perpendicular-sided excavation, where the clamshell alone could not have cut a straight-sided excavation.

Although the ground was badly frozen when the excavations were cut by the ditcher, there was no necessity for using salamanders. Excavating was started February 22 and required about three weeks. During this period there was a severe change in the weather during which the temperature moderated to such an extent that no difficulty was encountered as far as freezing of concrete was concerned.

In addition to having to go through 24 inches of frozen ground, it was necessary for the ditcher to tackle old house foundations. In going through these sections of foundation, the overload release sprocket protected the ditcher against damage.

CONCRETING

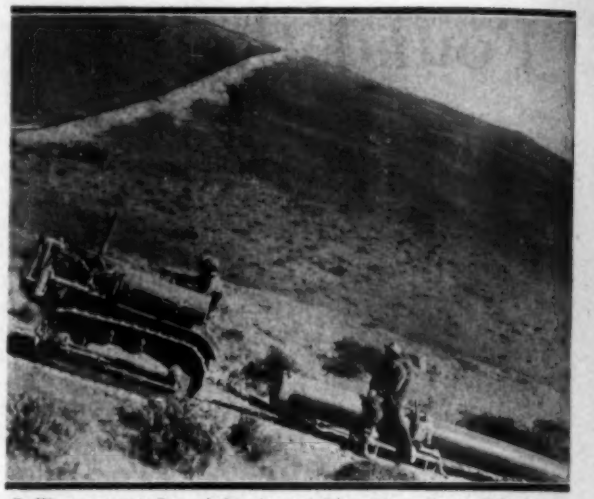
There were 46 piers in all. In these excavations 2-foot mat footings were first poured, then a 4 x 4 form was set for the columns and the concrete poured so that the base of the pier filled in the excavation for 2 feet without any form. The 4 x 4-foot column went up 2 feet to where a 36-inch diameter round column started. Pouring the base in the excavation without forms gave it the exact size and shape desired without the weakness and expense of any excavation, building forms and backfilling.

In pouring the footings a Jaeger 14-cubic foot mixer was used, which was moved to three different set-ups. Aggregate was brought to the mixer and measured in wheelbarrows. A 1:2:4 mix was used. The concrete was distributed from the mixer by wheeling also, and dumped at the edge of each pier excavation into a wooden chute which carried the material to its place in the excavations and forms.

Since two sides of the addition came adjacent to other buildings, it was necessary to have eight cantilever piers. The ditcher also cut the vertical sided outline of these in dimensions averaging about 24 feet by 12 feet. The maximum depth of excavation on the whole job was 8 feet with an average of about 6 feet.

A Book Telling What Engineers Do

A 265-PAGE well-illustrated, non-technical well-indexed book under this title has been written by Walter D. Binger, M. Am. Soc. C. E. and President, Thompson & Binger, Inc., New York. The author has taken the attitude that the average man does not really know what engineers contribute to the daily life of the community and so he has written this volume, totally devoid of technicalities, for the education and edification of the lay mind. The book makes interesting reading for anyone and everyone. He tells how materials can influence construction, he describes the steel age of construction, the use of concrete, the making of foundations, works under water, the science of surveying, the creation and use of topographic maps, how the land is measured, how various heights are measured, the use of aerial photography and practical astronomy, the construction of bridges, the fireproof and earthquake-proof qualities of modern buildings, the construction of highways and railroads, the creation of water supplies and the continuous fight of man in controlling floods and his persevering development of hydro-electric power. The book is published by W. W. Norton & Co., Inc., New York, at $2.75 per volume.



Pulling a 1,500-Pound Section of Pipe Up a Steep Hill in the Construction of the Natural Gas Pipe Line

A 300-Mile Pipe Line Job

A $9,000,000 natural gas pipe line and reservoirs are rapidly nearing competion to give California cities, particularly the San Francisco Bay area, cheap fuel for home and factory. The line leads north from the Kern County fields, nearly 300 miles south of San Francisco and Oakland and a tap line reaches Fresno.

The Pacific Gas & Electric Co., which is building this line to tap the great natural gas wells of Southern California and bring this by-product of the oil fields to the industrial cities farther north, expects to complete the job by August. From San Jose at the southern end of San Francisco Bay, the line splits, a branch going up each side to San Francisco and Oakland, supplying more than a score of cities and towns having a population aggregating a million.

The laying of the pipe line is simple enough over most of the course as it is straight and level up the San Joaquin Valley for the greater portion of the distance. In the hills south of San Francisco, however, the grades are steep and through rock formation where pneumatic drills have been used to advance the line 150 feet a day with a crew of 24 men.

Caterpillar tractors have been used to bring the heavy compressors mounted on motor trucks up and down the 20 to 60 per cent grades. They are also used to haul the pipe on steel sleds and to backfill the ditch after the pipe is placed.

A Caterpillar Thirty With a Killefer Bulldozer Backfilling the Natural Gas Line Trench Just Outside San Francisco

The Bugaboos of Grading and Paving

By A. Stellhorn
Wooster, Ohio

OAD building operations must conform to the fundamentals which underlie the economies of both construction and manufacturing operations. They must, in addition, adjust themselves to other hazards and limitations which some think almost remove road building from the realms of legitimate business and place it in the same class as gambling and playing the stock exchange. There are five major requirements to be met in road building; 1, suitable equipment; 2, efficient personnel; 3, good management; 4, good weather; 5, competent engineering supervision. The first three requirements are under the control of the contractor, and the nearer perfection is attained along these lines through ability and experience, the stronger the financial standing of the individual contractor.

The Hazards

The hazards involved under the weather and engineering supervision must be faced as something that cannot be controlled. Good weather and efficient engineering supervision are highly to be prized, and should be utilized to the maximum possible.

Bad weather and poor engineering supervision must be put up with, and the bad effects minimized to the greatest degree possible. Since these two hazards do materially limit the total amount of work that can be done in a year, they cannot be ignored, but must be allowed for in laying out a season's construction schedule.

Influence of Weather Conditions

It is not conceivable that it ever will be possible to grade and pave under factory operating conditions. Therefore, it will never be possible to approximate the efficiency that is being obtained in many manufacturing concerns.

What is the effect of the weather on employment? In the northern section of the country there are somewhere between 120 and 160 days in the year which, under the current specifications for public works, concrete pavement can be constructed and about 225 days in which grading operations can be carried on. These are not the number of days the contractor might find it expedient to work, but the actual number of days that engineers will permit work to be done.

The days lost from paving operations in the north include not only the loss of time during the winter months when no work can be carried on for comparatively long intervals of time, but also the days lost during the normal working season due to low temperature and rains. The reason for the much larger number of days for the grading operations is due to the fact that rain only occasionally completely closes down grading operations, and that much greater frost action can be disregarded in grading than in paving. Today any contractor who operates in the north knows that his equipment and men can only be efficiently employed somewhere between 40 to 75 per cent of the 300 nominal working days of the year.

Engineering Supervision—Cooperative or Incompetent

There must be cooperation and understanding between the contractor and the engineer or work cannot progress satisfactorily. This does not only mean that adequate lines and grades must be furnished to contractors, but that the engineer is alive to the problems involved in any given operation, that extra work, if required, is decided on in time to avoid delaying the general progress, and that the small differences between engineer and contractor that invariably arise on any job be quickly and justly settled.

The engineer invariably takes a large share of the credit when good progress is made and excellent quality obtained, and, furthermore, he probably deserves all the credit he gets under such circumstances, but when work does not proceed properly and poor progress is made, the engineer is very prone to place the responsibility entirely on the contractor's shoulders, whereas, he is probably as much to be blamed in the one instance as he is to be praised in the other.

Partial and Final Estimates

The paying of partial and final estimates on a job is another point which comes under engineering supervision. Unless a contractor has unlimited credit, partial or monthly estimates must finance his work. Laxness and delay in making and paying these final estimates are apt not only to embarrass the contractor financially, but actually to seriously hurt his credit, and when that happens it is reflected back on the job. A contractor whose credit is poor will also be a contractor who makes poor progress on his work.

The Engineer a Liaison Officer

The engineer is the liaison officer between the contractor and the public. It is his job to see that the contractor does his work according to plans and specifications and that the state or municipality receives one hundred cents worth of work for every dollar expended. The engineer has no moral or legal right to ask for anything more than that called for by the contract, just as he can be satisfied with nothing less.

The paving contractor is in a rather peculiar predicament. He has a flock of engineers and inspectors on his work all the time, but it does not mean a thing. If the pavement is rough the contractor either donates it to the state or replaces it. If under thickness, the same process holds good and if under strength, although he has not one thing to say about proportions, time of mix, water content, method of compacting, etc., he is told to add 10 per cent of additional cement to bring it to the required strength.

If all the requirements laid down are followed and the resulting pavement is too thick or the strength much higher than required, the contractor is a wonderfully fine fellow and is beneficently smiled upon.

DONATIONS DO NOT PAY DIVIDENDS

The contractor's job is to give the engineer a smooth pavement of the required thickness and strength without undue donation, if any. This is not always easy. I am thinking of a 7½-mile pavement 20 feet wide that satisfied everybody while being built, but when cored it averaged one-half inch over thickness. Just figure and see how much wasted concrete there was in that job. It amounted to about 1,200 cubic yards or the equivalent of over 6,000 square yards of standard pavement, or over $12,000 thrown away. If a 7-inch pavement is called for, there is no sense in giving the state or municipality a 7½-inch pavement. The margins on which pavement construction are bid are too small to deliberately throw away $1,600 a mile. The only solution is for the contractor to satisfy himself that he is getting the required thickness and make the engineer see it his way.

HOW TO CHECK THE SUBGRADE

My own peculiar way is to set the screed of the finishing machine and the subgrader absolutely dependent on each other. Then, subgrade a section of grade and check for the required thickness while running the finishing machine in front of the mixer and testing the grade. This may seem somewhat of a nuisance, but it pays real dividends. A scratch board is an abomination and if conscientiously used usually means a grade from ⅛ to ⅜ inch low.

OVER-RUN AND UNDER-RUN OF CEMENT

The whole question of extra thickness and extra cement is of vital importance to the contractor. Some engineers seem to feel it their duty to obtain more cement than that called for. Others seem to be particularly pleased when extra cement is used. A job that has a ½-inch greater thickness than called for or one that has a material over run of cement has had just as poor engineering supervision as one that is under thickness and has been skimped in the amount of cement used.

This matter of over-run and under-run of cement brings to mind a comparatively new method of concrete proportioning, namely the weighing of aggregate. There is a lot of grief ahead for both engineers and contractors before this method is really workable under the various road building conditions. Coarse aggregate in Ohio varies from 70 to 100 pounds per cubic foot, sands vary somewhat but not nearly so much. The same rules could not apply even to the same type of materials. Youngstown slag and Wellston slag are two entirely different things. Wagner Soldier Home Quarry limestone is different from Marion limestone and so on. Even the gravels vary to a considerable extent. If these new methods of proportioning are specified before the whole matter has been thoroughly digested, there will be a great deal of wasted material and also a lot of wasted time and effort paid by the road building fraternity before the peaks are ironed out. If stone weighs more than the engineer has decided it does, the contractor donates expensive cement.

It has always seemed to me that the way to specify concrete proportioning is a given amount of cement to a cubic yard of mixed concrete. Any method of control to obtain that result is all that is needed or wanted as far as cement content is concerned. The uncertainty of what will be asked for and insisted upon by the engineer on a particular job makes for higher cost and decreased efficiency. If all the work of a contractor's organization could be done under one man, it would not mean so much. Today, when an organization will build 4 to 16 different jobs in a year, in as many different localities, probably all under different engineers, these questions begin to be of real importance.

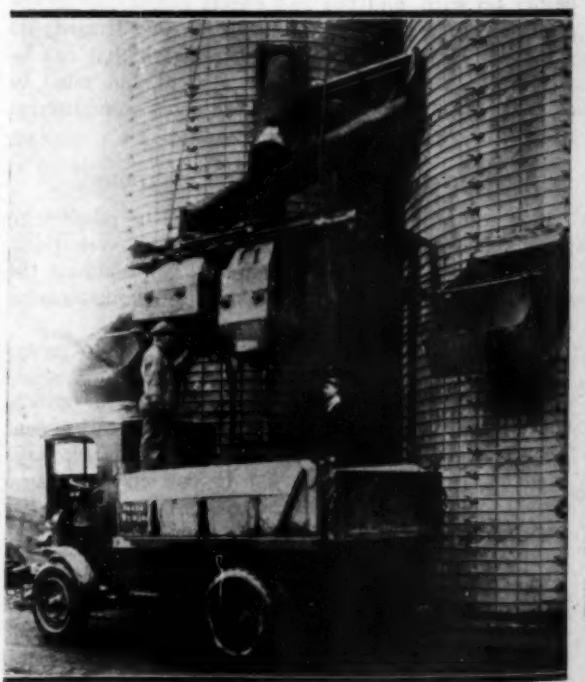
ACKNOWLEDGMENT.—An abstract of a paper presented before the American Road Builders Association.

An Inspirational Hauling Record

IN a year when notable achievements are every-day occurrences in the construction field, the Contractors and Builders Supply Co., of Peoria, Ill., has established what is believed to be a record. One man driving a single-4-cylinder 2½-ton, 114-inch wheelbase Autocar truck hauled 253 tons of sand and gravel approximately one mile to a job in 9 hours.

W. C. Gill, General Manager of the company, stated that he believed this can go down as a record tonnage for a single truck and driver, as the driver had no assistance in loading or unloading. The quick loading facilities of the Godfrey-Neff and Fry storage bins and the truck made the handling of this tonnage possible. Considerable credit also goes to Elmer Roberts, the truck operator who made this record. He has driven this truck daily for 18 months at practically no cost for repairs.

Whether this haulage is a record or not, is really insignificant for, on the day it was accomplished, the driver made no resolution to compete for haulage honors. It was just a day's work for him, but a day's work that is worthy of being recorded for the inspiration of other contractors.

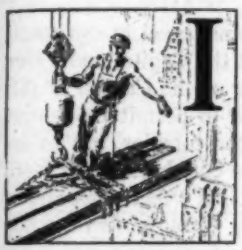


THE TRUCK DRIVER, BINS AND TRUCK WHICH MADE POSSIBLE THE HAULING OF 253 TONS OVER A ONE-MILE ROUTE IN NINE HOURS

The man in the black sweater is merely an onlooker and not a helper

114 Per Cent Increase in Construction Accidents

Federal Bureau of Labor Statistics Reports Lamentable Condition in the Building Construction Industry in New York State



INCREASING accidents in the construction industry compared to the decrease in the manufacturing industries, presents a problem of no small significance, according to a statement of James J. Davis, Secretary of Labor, in calling attention to the recent report of the Bureau of Labor Statistics. In the State of New York alone, the increase from a total number of 10,230 accidents in the year ending June 30, 1923, to 21,891 in 1928, gives an alarming indication of the need for a reformation in the care of, or working conditions faced by, employees in the construction industry.

Increase Not Confined to New York State

An upward trend is also noticeable from reports received from Ohio and Pennsylvania. It is probably equally apparent in other districts.

It may be argued by some that the figures which show an increase in the number of accidents do not show an increase in the accident rates, and that that increase is due solely to an increase in the business, which requires a larger number of workers. But, so far as is known, no State has yet been able to secure the volume of employment in the construction industry.

It is interesting, however, to note the National Safety Council's reports for a period of four years, which show that 59,707,836 man-worked hours yielded an accident frequency rate of 65.07 as against a frequency rate of 58.81 in 1924, and a severity rate of 7.13 in 1927, against a severity rate of 4.60 in 1924.

Premium Rates Necessarily Increase

The hazard manifested by the increase in accidents in the construction industry is strongly reflected in the premium rates charged for workmen's compensation insurance. The compensation in the cases in that State averaged $371 per case, which is $72 per case more than the average for all industries combined, meaning as, Ex-Commissioner Hamilton, of New York, says, "that the accidents in building work cost about $1,500,000 more than an equivalent number of accidents at the average rate."

Accident Insurance a Large Item of Cost

Thus, high accident insurance means a large item in construction cost, and high construction cost is a strong incentive to poor construction. An honest and safe builder is thus put at a disadvantage in bidding, and the building owner may be defrauded in poor construction.

The problem does not stop at this point. It extends onward into the money market, where bankers may decide to restrict the loaning of money on shoddy construction work, because accident costs and bank credits are inseparably connected.

It is vital for the banker to be able to estimate accurately upon the longevity of the building upon which he is advancing sums of money which might be more profitably and more safely invested elsewhere.

New Safety Standards Imperative

It cannot be denied that new standards of safety are needed on construction projects. This could be provided for, to a large extent, by State legislation; and, in the case of National government buildings, by the Federal Government.

State codes providing for the protection of employees on buildings could be enacted or revised, and a council of State officials could be held for the purpose of formulating a building safety code, making regulations uniform and in other ways looking to the curtailing of the building construction hazards which are at this time menacing the lives and limbs of our workmen and bringing about unwelcome changes in the financial markets that are directly or indirectly allied with building construction.

Interesting Data on Industrial Accidents Compiled by Committee on Accident Prevention

INTERESTING data is contained in a bulletin recently issued by the Committee on Accident Prevention of the Building Trades Employers' Association of New York. The purpose of this bulletin is to enable each firm to compare its own accident record with the records of others in the same line of business; to provide a typical cross section of the experiences of the Association's membership so that trends of lost time accidents occurring in the New York Metropolitan District may be studied and compared by trades and to convince skeptics that accidents can be reduced through organized and well directed efforts.

The bulletin contains a large number of tables based on the industrial accident experience of 213 firms during 1928 and the reports are classified into 17 different trade groups. The combined frequency rate, which expresses the number of lost time injuries per 1,000,000 hours of exposure or man-hours worked, equals 49.67. This compares favorably with the average rate for the past two years of a group of building contractors reporting to the National Safety Council, which was 69.31. Many other deductions are made from a study of these tables.

The chief purpose of studying these statistics is to furnish a clue to accident prevention and copies of this bulletin as well as the other safety bulletins of the Committee, may be secured gratis by writing to the Committee on Accident Prevention, Building Trades Employers' Assn., 2 Park Avenue, New York.

Tunnel to Furnish Steam for New York State Office Building

By H. W. Lockwood,

Supt. of Construction, State Department of Public Works, Albany, N. Y.

ARRANGEMENTS for heating the new State Office Building now under construction at Albany, N. Y., required the furnishing of steam from the existing state power house on Sheridan Avenue which at present supplies heat to the State Capitol, State Education Building and Old State House. The existing tunnel from the power house to the Capitol was of sufficient size to accommodate the changes in piping, but it was necessary to construct a new tunnel from the Capitol to the State Office Building.

The new tunnel is of the twin type, comprising both pedestrian and service tunnels. The work, as originally contracted for, contemplated the construction of a two-deck structure with a pedestrian tunnel above the service tunnel from a point under the west entrance of the Capitol to an expansion chamber which was to have been built midway between the buildings, from which point the tunnels were to be carried side by side to the basement of the office building. As excavation proceeded, however, unsatisfactory soil conditions were found at the Capitol end, and to avoid any possibility of damage to the west entrance of the Capitol, it was decided to carry both tunnels at the upper level the entire distance between buildings, the service tunnel turning north at the Capitol entrance running parallel with the building a distance of 87 feet and thence into the basement of the Capitol through an existing opening in the foundation wall.

Excavation and Concreting Operations on the New Tunnel Between the State Capital at Albany, N. Y., and the New State Office Building

Construction Difficulties

Considerable difficulty was encountered in constructing the entrance to the tunnel at the Capitol end. Due to the topography, the first floor of the Capitol at this point is sufficiently below grade to permit the tunnel entering directly into a first floor corridor, but to accomplish this it was necessary to cut through the foundation wall of the building, which is 8 feet thick and of solid granite, and also to cut through two granite foundation walls of the west entrance steps, which are about 3½ feet and 6 feet thick, respectively. The construction work under the entrance steps also involved considerable shoring of the stone platform and steps, installation of new structural steel framing to carry the stone work, and a general rearrangement of the supports of the structure to permit the passage of the tunnel. Cutting of the granite walls was accomplished with the use of a 120-cubic-foot air compressor and four air hammers.

Excavation

Excavation of the trench for the tunnel was done with a Lorain gasoline shovel equipped with a back-digger, five trucks being employed in removing the excavated material. The soil encountered was mostly of clay with pockets of quicksand occurring at the bottom of the trench. Had the original plan of a two-story tunnel been carried out with the additional depth of excavation involved, considerable difficulty would have been met, particularly as the original plans indicated that the excavation should be carried below the existing footings of the west porch of the Capitol. With the re-

vision in plan, however, no serious problems were involved.

CONSTRUCTION

The concrete structure of the tunnels consists of two passages side by side, each 8 feet wide by 8 feet 2 inches high, with an 8-inch wall between and 10-inch side walls. The floor and roof slabs are 8 inches thick, except where passing under Capitol Place and Swan Street, at which point the thickness of both the floor and roof slabs are increased to 10 inches to withstand the additional loads. The length of the twin tunnel from the Capitol to the Office Building is approximately 495 feet.

WATERPROOFING AND EXPANSION JOINTS

Waterproofing of the structure is being accomplished by the application of a 5-ply tar felt membrane to a 2-inch plain concrete base slab, installed under the reinforced concrete floor slab of the tunnel, carrying the tar-felt membrane up the outsides of the exterior walls with a 4-inch brick protection, and across the top of the roof slab with a plain concrete protection 2 inches thick at the edges and 3 inches thick in the center.

Expansion joints of ½-inch premolded composition were installed at intervals of 40 feet 10 inches, with the thickness increased to 1-inch at the juncture of the tunnels with the buildings. Where the tunnels join the office building, additional precautions with regard to the joint were taken to accommodate any possible settlement of the building. Removable plates are to be placed over the joints in the floor, side walls and roof to permit inspection and calking should any leaks occur.

A ½-yard Ransome mixer is being used for the floor and roof slabs and walls and a 7-cubic foot Republic mixer for the 2-inch base slab and the concrete protection for the water-proofing on top of the tunnel.

FINISH

The finish of the pedestrian tunnel consists of 4-inch glazed buff terra cotta blocks on the exterior walls with 2-inch glazed blocks on the division wall and with flush pilaster effects at intervals of 20 feet 5 inches. The ceiling is of metal lath and cement plaster, extending down the sidewalls about 22 inches to a cap molding on the glazed terra cotta. The tunnel runs half the distance on a slight upgrade, but the ceilings are constructed in level sections with false beam effects at the pilasters. The floor of the pedestrian tunnel is of quarry tile laid on 2-inch terra cotta blocks. The service tunnel is unfinished other than 2-inch cement floor topping on structural slabs. A pipe intake with a ventilating louvre is provided in the service tunnel about midway between the buildings.

The service tunnel is designed to carry a 15-inch low pressure steam main, 8-inch and 6-inch high pressure steam mains and a 6-inch return line. The pedestrian tunnel is illuminated with recessed ceiling domes and the service tunnel with ordinary ceiling receptacles.

PERSONNEL

The general contractor for the construction of the tunnel is Feeney & Sheehan Construction Co., with the excavation sublet to Kilby Bros., form work to A. & J. Holmberg, and waterproofing to the United Roofing Co., all of Albany, N. Y.

Piping for the heating work is being run by the Power Efficiency Co., which concern has the contract for heating work in the new State Office Building. Electric work is being installed by Walter H. Taverner Corp., of New York City, electrical contractor on the office building.

Practical Method of Stripping Fertile Soil from Building Sites

TOO often do we see cases of excavation for basements where the clay or gravel subsoil is piled on top of a fertile top soil, ruining it for further use. An interesting stripping job in which the black dirt was removed by scrapers and replaced after a gravel fill had been made is told in a recent issue of *Sauerman News*.

The city of Dixon, Ill., is building a new high school along the banks of the Rock River which flows only 200 feet away from the near side of the building. In order to avoid a possible overflow in case of high water in the river, one of the early problems of construction was to raise the level of the building site several feet and it was found that this could be done most economically by taking material from the side of the adjacent river for gravel fill.

Instead of piling this gravel on top of the fertile soil, however, the school authorities let a contract for stripping off several feet of the black dirt and later replacing this soil on top of the gravel fill to furnish suitable soil for the lawn. This contract was awarded to Johnson, Palmer and Cox, a contracting firm of Dixon of which F. M. Johnson is principal owner.

The site to be stripped was about 350 feet long and 600 feet wide. The soil removed was for the most part black river-bottom soil of excellent fertility but inclined to be rather sticky when wet which complicated the problem of moving it. The stripping averaged 2 to 3 feet in depth over most of the area, but varied to allow for the selection of the best soil and totalled about 8,500 cubic yards.

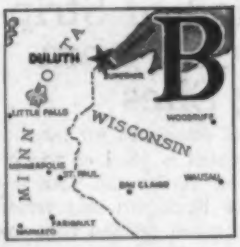
All of this dirt was removed with three ½-yard power drag scrapers operated by Fordson tractors and automotive hoists. These machines were set up in the middle of the area and the scrapers worked out toward the sides, instead of working across the whole area in one span, and piled up the dirt in an embankment around the boundaries of the building site, leaving openings to permit access of machinery and materials.

The gravel fill is being made to a depth varying from 3 to 10 feet to bring the whole area to grade and when this is done the scrapers will be used again to replace the black dirt that was removed.

The time allowed by the School Board for the completion of the stripping was 60 days and, although the work was delayed for a few days by the rain and not all of the machines were used all of the time, the job was accomplished well within the time limits, making progress that was entirely satisfactory to the School Board. Mr. Johnson, owner of the contracting company, reported, "The scrapers operated very satisfactorily and excited much interest and favorable comment in the city, as teams are high in price and hard to secure on work of this nature. We think that the small tractor-driven scraper will easily handle from 100 to 150 yards per day on difficult work of this kind. We were able to pile the dirt up to a height of 10 and 12 feet without difficulty. Some plowing was done in order to enable scrapers to load more readily. From our experience we think that dirt can be handled at a cost of from 25 to 30 cents on this kind of work."

Stack Felled on Prescribed Line

Method Used by Whitney Brothers Company In Demolishing Concrete Chimney For Zenith Furance Co.



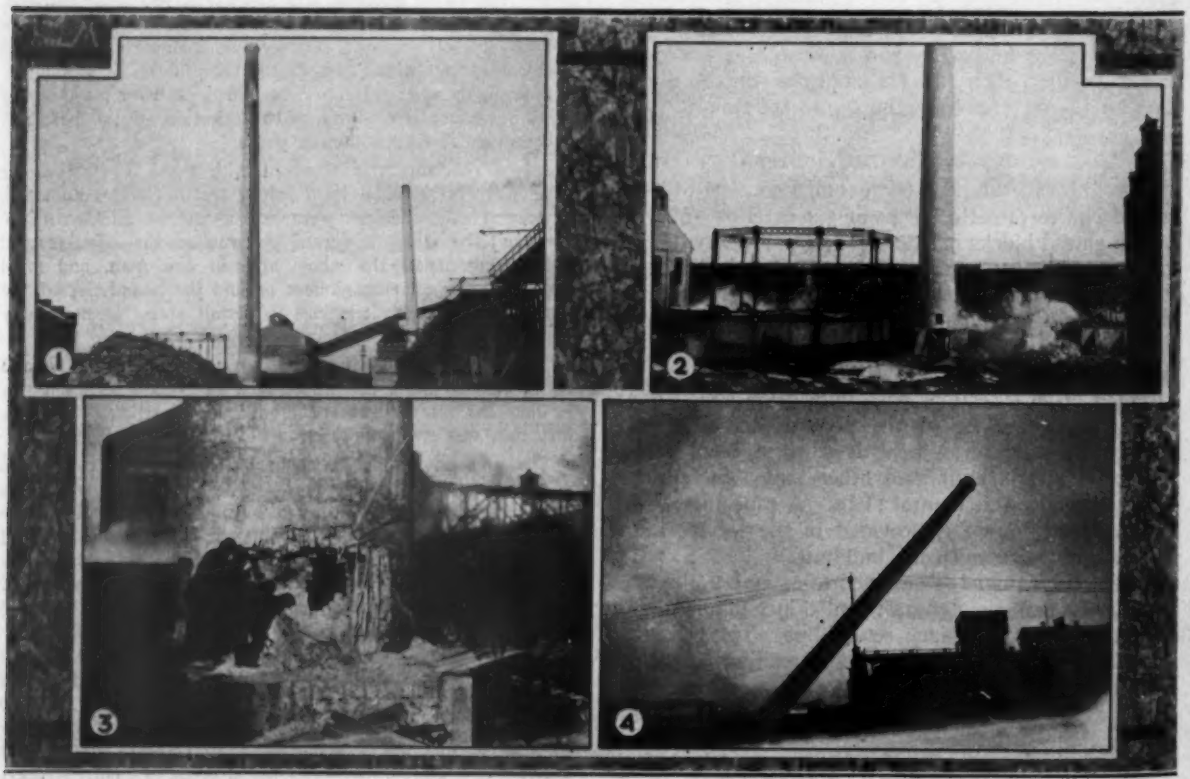
BECAUSE of new construction, it was necessary to remove a concrete brick-lined stack at the Zenith Furnace Co., plant at Duluth, Minn. This stack was 225-feet high, 13 feet, 6 inches in diameter at the base and 9 feet, 4 inches in diameter at the top.

In felling this concrete chimney, it was necessary to drop it within very restricted limits of adjacent structures. To insure its fall on exactly the line desired, a locomotive was used to pull the stack over. The pull was exerted by a cable attached to the top of the stack and to the locomotive. The stack was first undercut on the side toward the locomotive by a system of carefully laid out holes which were drilled and blasted and the exposed reinforcement burned off. The opening thus formed was wedge shaped with the highest point of the wedge directly toward the locomotive.

When blasting had formed an opening half way through the stack, six additional holes were loaded at the two points of the opening. The locomotive was then signalled to pull ahead and at the instant of the start of the pull the six holes were fired by an electric battery and the stack fell on the exact line desired.

We are indebted to I. W. Ward, superintendent for Whitney Brothers, Duluth, Minn., for this material.

The Men Who Laid the 225-Foot Stack Low. J. Hallock, I. W. Ward, Engineer and Superintendent, Respectively, of Whitney Brothers Company



EXPLOSIVES AND A LOCOMOTIVE DEMOLISH A CONCRETE CHIMNEY IN DULUTH

1. The 225-foot stack with the pulling cable attached. 2. One explosion, blasting out the under-cut on the side toward the locomotive. 3. Burning out the reinforcement in the blasted section. 4. The stack falling on the line desired.

Two Needless Accidents Results of Carelessness

ONLY a few weeks ago a steel girder slipped from a crane when it was being hoisted to the fourth floor of the 36-story annex to the St. George Hotel, Brooklyn, N. Y. The girder crashed to the first floor where a group of men were working, injuring two of them severely, one suffering a fractured leg and the other lacerations of the scalp.

Great care must be taken by foremen and laborers in the handling of steel to make sure that the hoisting slings are attached to girders properly and that there is no chance for them to slip and cause injury and possible loss of life. A sling or bridle should consist of two slings of 1 or 1¼-inch steel wire joined by an eye which engages the hooks of the hoisting block. Care must be taken that the load is properly balanced and it must be guided carefully to prevent its hitting any protruding portion of the structures already built which may cause the sling to slip and up-end the girder.

Another accident of a similar nature occurred in East Orange, N. J., when a makeshift hoist collapsed while a bathtub was being hoisted to the top floor of a four-story building being erected at 174 North Grove Street. The falling tub cleared two men standing below but the planks and accompanying material struck and killed them instantly.

An investigation of the matter showed that 3-inch planks had been thrust over the edge of the roof to act as a support for the hoist, their inner ends being anchored by 25 bags of slag. They succeeded in raising the tub more than half way when the strain proved too much for the anchorage of planks. They tipped and slid off the roof and plunged with the tub and tackle to the street below. Police investigation disclosed that while the bags of slag used for anchorage were supposed to weigh 40 pounds each, many of them did not weight half that much.

International Newsreel Photo

The Scene of the Accident on the St. George Hotel, Brooklyn, Where Two Men Were Injured by Falling Girder

The Best Method of Raising a Guy Derrick

THE most difficult procedure in the handling of a guy derrick in steel construction is in raising the derrick and in making the first move upward from the basement. The following steps are necessary:

(1) Place two 20 by 20-inch timbers on the beams of the floor to which the derrick is to be raised, one timber on either side of the mast.

(2) By means of a foot-block raise the boom enough to permit removal of the pin.

(3) Turn the boom 180 degrees thus placing the hoisting block next to the mast, and steady the boom with the temporary guys which have been stored inside the boom.

(4) Attach the hook of the hoisting block to a lashing placed around the mast at a predetermined elevation, at the same time fastening the foot-block to the mast with turnbuckles.

(5) Release the mast guys, hoist the mast and foot-block to the 20 by 20-inch timbers, and transfer the guys to anchor slings that have been attached to column tops spaced about equally and with due regard for the area which will be required to land the steel hoisted from below.

(6) Release the temporary boom guys, raise the boom, and insert the foot pin.

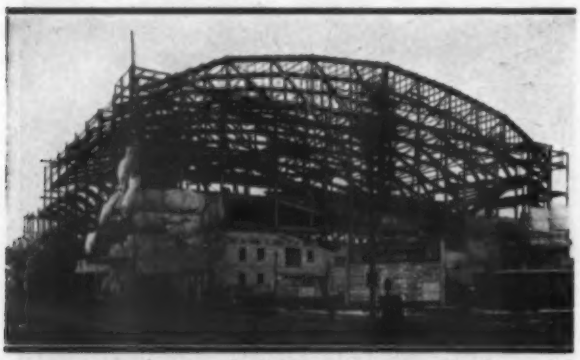
The time required to raise a guy derrick is 2 hours, although the first move up from the basement usually takes longer. On all successive raises the guys are placed on the same columns unless the size or shape of the building changes.

This abstract is from a report of the Committee on Construction Plant and Methods for Steel Buildings which was published in the March, 1929, *Proceedings* of the American Society of Civil Engineers.

The Early Stages of Steel Erection for the Chicago Stadium December 18, 1928

Construction of the Chicago Stadium

THE Chicago Stadium, recently completed, provides a structure having a large indoor seating capacity, suitable for sports events, exhibitions and a variety of attractions. It seats as many as 20,000 people in the main auditorium, the plan being similar in many respects to the famous



View from Opposite End of Chicago Stadium Showing Beginning of Stone Work and Method of Protecting Workers

Madison Square Garden of New York City. It is located on the square block bounded on the south by West Madison Street, on the east by North Wood Street, on the north by Warren Avenue and on the west by North Lincoln Street.

Progress of Steel Erection on January 7, 1929

There is frontage of 600 feet on West Madison Street, 266 feet on Wood Street, 600 feet on Warren Avenue, and 266 feet on North Lincoln Street.

The Chicago Stadium, designed by Hall, Lawrence and Ratcliffe, Inc., measures 300 feet by 266 feet, exposed on four sides and having masonry walls 89 feet high.

DETAILS OF CONSTRUCTION

Four large stone pylons flank the four corners of the building. The south and north street walls on Madison Street and Warren Avenue are faced entirely with stone, whereas the east and west walls, facing Wood Street and Lincoln Street, which may be extended at some future time are faced in brick.

An heroic frieze of sculptured athletic scenes and figures 89 feet above the ground encircles the entire building in panels between wide masonry pillars rising from an unbroken base of solid ashlar masonry 31 feet high. The top of the masonry wall, 89 feet high is surmounted by a vaulted roof, spanning the large arena and rising to a height of 117 feet 6 inches. The structure is supported on a steel skeleton frame, supporting the steel roof trusses and reinforced concrete balconies.

The building is roofed with large exposed 23-foot high steel trusses, spanning the entire width of the building. The bottom chord rises from a height of 67 feet at the side walls to a height of 89 feet down the center.

The inside exposed roofing surface on top of the trusses is finished in Holorib metal deck, covered with a double layer of insulating sheets with asphalt coatings and a 3-ply composition.

The entire inside walls of the arena are light colored face brick attractively treated in panels and designs with darker colored face brick.

Yellow Skyscraper Skeletons

A BRIGHT yellow steel frame for a skyscraper is going up at Seventh Avenue at 37th Street, New York. This is the first use of color to advertise the work of a steel fabricator. The job is being executed by the Hay Foundry & Iron Works, New York, fabricators of structural steel and they have decided that hereafter this coating of yellow will designate their work throughout the city.

Structural steel usually arrives on the location painted a dull red. It is coated with this paint as a means of preserving its surface. As the structural steel is erected, the red is painted over with a coat of black. The Hay Foundry & Iron Works has decided to break this tradition and hereafter it will paint all of its erected steel a vivid yellow. The new color application makes its first appearance on the Louis Adler Building.

The selection of an appropriate and at the same time a distinctive coloring for structural steel was considered most important. Its advertising value can be obtained only while the steel framing of a skyscraper is standing unadorned. In the brief space of a few weeks it must make its appeal to the thousands who pass it daily. It is a common practice for contractors to attempt obtaining some advertising value from the distinctive appearance of their tools and equipment. It is usually the case that these are all painted the same color and the lettering on the carts, wagons and tool houses is the same in style. These, however, rarely appear above street level whereas the yellow steel frames will project themselves several hundred feet into the sky and be plainly visible for miles.

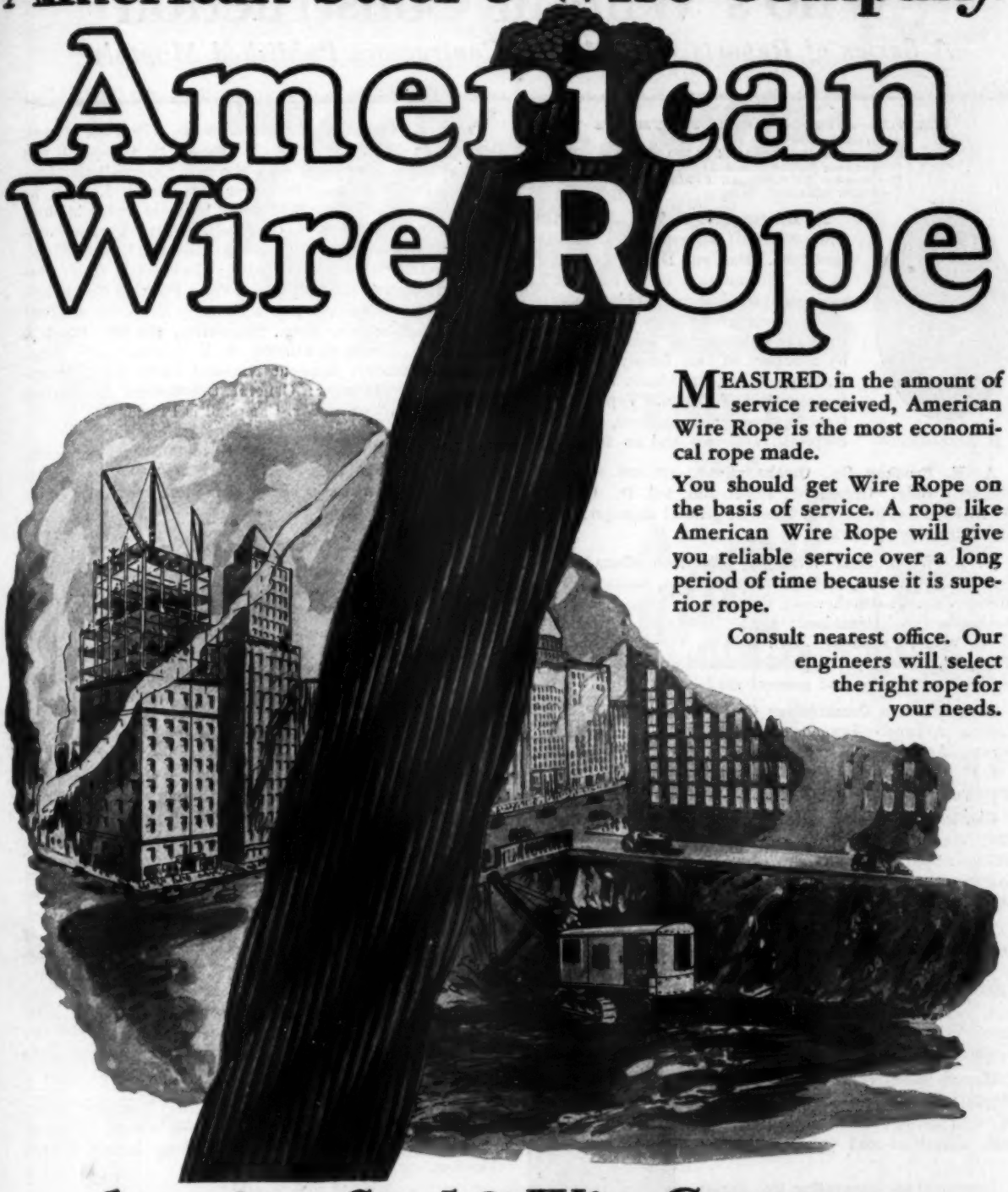
Richmond-Hopewell Bridge Hearing

THE War Department on March 9th, 1929 held a public hearing with regard to the application of the Richmond-Hopewell Bridge Co., for a permit to construct a highway toll bridge across the James River below Dutch Gap, Virginia. The bridge company was represented at this hearing by its Chief Engineer, P. K. Schuyler.

The State Highway Commission of Virginia on January 28, 1929, granted a permit under the Virginia General Law allowing the construction and operation of this bridge.

American Steel & Wire Company

American Wire Rope



MEASURED in the amount of service received, American Wire Rope is the most economical rope made.

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D—Between $250,000 and $500,000
E—Under $250,000

H. Longenecker

H. Longenecker & Sons, Greenville, Ohio, 524 East Fourth Street. Organized 1884. Bus. vol. D. This company is the continuation of a contracting business started about 1830 by the present owner's grandfather. Since that time the business has been carried on by members of this family. Officers: H. Longenecker, President; William M. Longenecker, Foreman. Type of contracting: residences, schools, churches, hospitals, armories and so forth.

A. H. Brodkey Co., Omaha, Nebr., 492-498 Saunders Kennedy Bldg. Organized: 1924. Bus. vol. D. Officers: A. H. Brodkey, owner; R. Mueller, general manager. Type of contracting: general.

G. B. Wood, Ltd., Winnipeg, Manitoba, Canada, 194 Sutherland Avenue. Branch offices: Regina, Saskatchewan; Moose Jaw, Saskatchewan; Calgary, Alberta, Saskatoon, Saskatchewan. Organized: 1922. Bus. vol. D. Officers: G. B. Wood, President; J. O. Allison, Vice-President; W. Turnbull, Secretary. Type of contracting: heavy haulage, road oiling, paving and general road construction.

Dick & Blake Construction Co., Milwaukee, Wis., 4608 Lisbon Avenue. Branch office: 403 East South River Street, Appleton, Wis. Organized: February, 1928. Bus. vol. E. Officers: W. E. Dick; Walter Blake. Type of contracting: bridges, sewage plants and filling stations.

Charles and George K. Thompson, Los Angeles, Calif., 2301 West Ninth Street. Organized: 1915. Bus. vol. B. Officers: Charles Thompson, George K. Thompson. Type of contracting: tunnels, bridges, irrigation and drainage, dams and levees.

Tolmie Brothers, Inc., Rockford, Ill., 919 Taylor Avenue. Organized: March 1, 1920. Tolmie Bros., was organized as a partnership in 1920 and incorporated on November 1, 1928. Officers: George E. Tolmie, President; Hugh D. Tolmie, Vice-President; Tom W. Tolmie, Secretary and Treasurer. Type of contracting: industrial buildings, apartment houses and concrete structures.

Hyman Rabinovitz, New Orleans, La., 740 Poydras Street. Organized: 1923. Officers: Hyman Rabinovitz, owner. Type of contracting: residential, commercial, industrial and public buildings.

International Excavating Co., Jersey City, N. J., 1204 Labor Bank Bldg. Branch offices: 192 Market St. and 4 Fleming Ave., Newark, N. J. Organized: 1926. Bus. vol. D. Officers: Joseph S. Fay, President; Fred Romp, Vice-President; Edward Shinn, Secretary and Treasurer. Type of contracting: excavating, grading and road work.

Photo by Blank & Stoller

Edward Shinn

Frank S. Campbell, Kingston, N. Y., 170 Pine Street. Organized: 1926. Bus. vol. E. Frank S. Campbell was associated for four years with Michaud Campbell Co., Inc., as Vice President and Treasurer. On March 1, 1926, he entered the contracting field doing business under his own name. Officers: Frank S. Campbell, owner. Type of contracting: building. Recent contracts include Read's Kingston Theatre, Kingston, $110,000; Twaafskill Golf Club House, Kingston, $20,000; Jacob Forst Packing Co., Kingston, $90,000; Shapiro & Rubin Factory, Kingston, $45,000; N. Y. Telephone Co. Bldg., Saugerties, $25,000; Stock & Cordts, Inc., Kingston, $10,000; N. Y. Telephone Co. Bldg., Kingston, $95,000; Rondout National Bank Bldg., Kingston, $45,000. Member: General Contractors Association of Kingston, of which Mr. Campbell is President.

W. D. Berry, St. Petersburg, Fla., 207 Taylor Arcade. Organized: 1924. Bus. vol. C. Officers: W. D. Berry, owner. Type of contracting: general with specialization in fine residential work.

J. D. George

J. D. George Construction Co., Donna, Texas. Organized: 1925. Bus. vol. D. Officers: J. D. George, owner. Type of contracting: dragline excavation, timber bridges and pile driving.

Wills Construction Co., St. Louis, Mo., 6029 Clemons Street. Organized. January 1, 1928. Bus. vol. E. Officers: Russell V. Wills, President, E. Vernon Wills, Vice-President and Secretary; Emmett S. Wills, Treasurer. Type of contracting: canals, levees and timber bridges.

B. J. Jobst Building Co., Lincoln, Nebr., 416-417 Sharp Bldg. Organized: 1887. Bus. vol. E. B. J. Jobst started business in 1887 and was incorporated as the B. J. Jobst Building Co., in February, 1918. Officers: B. J. Jobst, President and Manager; H. R. Jobst, Secretary. Type of contracting: buildings and fine residences. Member: Master Builders Assn. of Nebraska; Lincoln Builders Bureau.

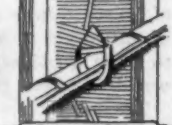
Farrar Guy Jackson Co., Denver, Colo., 314 Quincy Bldg. Organized: 1906. Bus. vol. D. Officer: Charles S. Farrar, President and Treasurer; William H. Guy, Vice-President; J. E. Jackson, Secretary. Type of contracting: general.

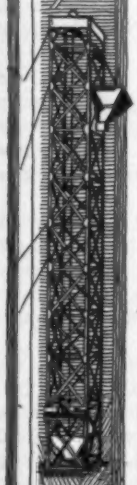
H. C. Land, Berkley-Norfolk, Va., 1005 Fauquier Street. Organized: 1919. Officers: H. C. Land, owner. Type of contracting: general building, including houses, stores, churches, etc.

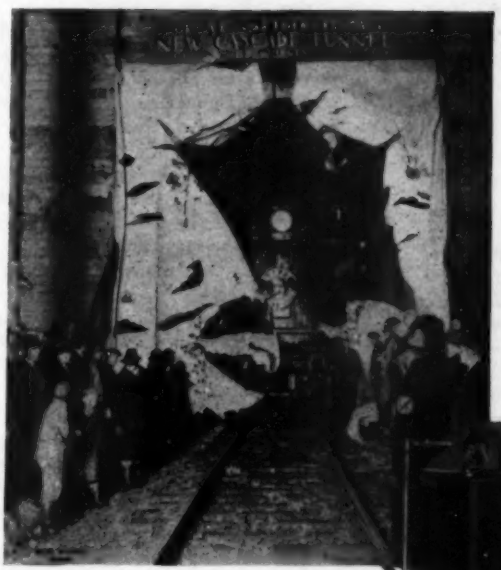
John Williams, Dorchester, Mass., 8 Beechwood Street. Organized: March, 1910. Bus. vol. E. Officers: John Williams, owner. Type of contracting: sewerage and water main construction and excavations.

The Martin Contracting Co., Philadelphia, Pa., Germantown Avenue and Durham Street. Organized: January 13, 1926. Officers: Thomas S. Martin, 3rd, President and Treasurer. Type of contracting: road, grading and drainage.

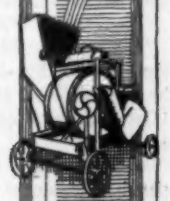
17 Ransome PNEUMATIC PLACERS







USED *by* A. GUTHRIE & Co.



Dedicating the Longest Tunnel in America

Five Ransome Pneumatic Placers were used by A. Guthrie & Co. on the West Portal of the Great Northern Tunnel—*five* on the East Portal and *three* at Leavenworth. These *thirteen* Ransome Placers placed practically 150,000 cu. yds. of concrete.

Three Ransome Placers were used on the Illinois Central Tunnel at Ozarka, Ill., to place 11,513 cu. yds.—and one more has just been shipped to St. Paul, Minn.—*a total of seventeen* up to the present.

Send for Bulletin 105-A which tells all about Ransome Pneumatic Placers

Ransome Concrete Machinery Company

1850—Service for 75 Years—1925

Dunellen New Jersey

Legal Points for Contractors

These brief abstracts of court decisions in the contracting field may aid you in avoiding legal difficulties. Local ordinances or state laws may alter the conditions in your community. If in doubt consult your own attorney

Edited by A. L. H. Street, Attorney-at-Law

Mistake Justified Cancellation of Contract

When a member of a firm of contractors added up a string of figures in an estimate on a job he put down a total as $99.10 when it ought to have been $859.10. That led the contractors to make a bid of $1,450.40 for the work, although the bid would have been $2,210.40 except for this mistake.

The owner accepted this bid and a contract was entered into, although, as found by a court, he knew that there must have been an error made in computing the bid. Later the same day, the contractors discovered the mistake and promptly notified the owner. They were willing to do the work for $2,210.40, or at as low a figure as any responsible bidder would be willing to do it if that should be less than $2,210.40. But they declined to stand by the bid made through mistake.

"Nothing doing," coldly replied the owner. "Carry out your contract or I'll have the law on you."

"Hop to it," replied the contractors.

The owner sued in New Haven for damages for breach of the contract but lost in the trial court, and lost again when he appealed to the Connecticut Supreme Court of Errors (Ceremia vs. Boyarsky, 140 Atl., 748, decided February 28, 1928.)

It was decided that, although the contractors were not entitled to a decree of court modifying the contract, they were entitled to a decree cancelling the contract on the ground that to compel its enforcement would enable the owner to take an unconscionable advantage of the contractors.

Failure to Pay Haulage Contractor Entitled Him to Abandon Contract

In the case of Arendsen vs. Edward D. Boyle & Co., 119 So. 282, decided by the Louisiana Court of Appeals December 10, 1928, plaintiff sued for a balance due for hauling curbing for a street improvement job. The defendant counterclaimed damages because the plaintiff had failed to do all the hauling he had agreed to do. The trial judge disallowed the counterclaim and entered judgment for plaintiff. Affirming the judgment, the Court of Appeals handed down an opinion of which the following is a summary:

Where, at time of oral contract for hauling stone, there was nothing said as to time of payment, the failure to make payment as the work progressed was justification for abandoning work after repeated demands for payment were ignored.

Paving Contractors' Income Tax

Contracts of a paving contractor, requiring him to maintain for five years streets and roads paved by him, do not entitle him to carry payments made to him under such contracts as a contingent liability during the five-year period. It was so decided by the United States District Court for the Western District of Pennsylvania November 1, 1928, in the case of Harrison vs. Heiner, 28 Fed. (2d) 985.

The court distinctly notes that this was not a case where a paving contractor was attempting to take credit for actual maintenance costs, but where the system of accounting erroneously assumed that there was no current net income, because of the contingent liability arising from the contract obligation to maintain the various paving jobs for five years.

Contractor Should Safeguard Against Contingencies

The opinion handed down by the New Jersey Court of Errors and Appeals October 15, 1928, in the case of Mansfield vs. Cape County, 143 Atl. 379, reaffirms the well settled rule of law that a contractor is not entitled to pay for unexpected extra work thrust upon him by accident, where his contract does not cover the point.

The report of the lawsuit indicates that the extra work involved in this case pertained to repairs and reconstruction work entailed upon plaintiff in the construction of a bridge, although the precise nature of this extra work is not disclosed. The important phase of the case appear in the following extracts from the opinion:

"No rule of law is more firmly established by a long train of decisions than this: that where a party, by his own contract, creates a duty or charge upon himself, he is bound to make it good, if he may, notwithstanding any accident by inevitable necessity, because he might have provided against it by his contract. . . .

"Where persons contracting with each other regarding what shall be their course of conduct with each other, regarding a certain subject-matter, and declare that there shall be no change in their agreement, which shall vest an additional liability in favor of or against each other, without authority to do so in writing, the mere performance of such extra service without such written authority will not give rise to an implied waiver of the provision of the contract in that respect; so without proof of alterations in the contract, by the parties, or express proof of waiver of its terms, the plaintiff in order to recover was bound to produce the order of the architect stipulated for in the agreement."

Employe Did Not Assume Risk

Although most industrial accidents are now covered by workmen's compensation acts, making the question of fault, as between employer and employee usually immaterial, there are still sufficiently frequent instances of accidents not covered by those laws to make it worth while to remember the principal aspects of an employer's common-law liability.

In the case of Young vs. E. A. Wood & Co., 146 S. E. 70, decided January 2, 1929, the Supreme Court of North Carolina affirmed judgment on account of death of a bridge carpenter who was knocked off a bridge pier by a bucket loaded with concrete. One of the principal points in the case was the question whether or not he assumed the risk of such an accident as an incident to his employment. The Court remarked:

"It might well have been held that plaintiff's intestate did not assume the risk of being struck and knocked off the pier by the bucket which passed over the place where he was required to work from time to time. It could not be held that plaintiff's intestate assumed a risk of which he had no knowledge, when, in obedience to defendants' orders, he went to the place at which he was directed by defendants to work. There were risks which were and must have been obvious to plaintiff's intestate. His injuries were not caused, however, by any of these risks, which it might well be held that he assumed when he went upon the pier to work."

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Roads must be built to withstand present and future loads. The concrete road properly designed and reinforced meets these conditions.

TRUSCON WELDED STEEL FABRIC—in flat sheets or rolls—and RIB BARS reinforce the concrete against cracking due to contraction loads and unequal subsoil.

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TRUSCON STEEL ROAD FORMS, rigid and durable, insure the accurate and rapid construction of the road.

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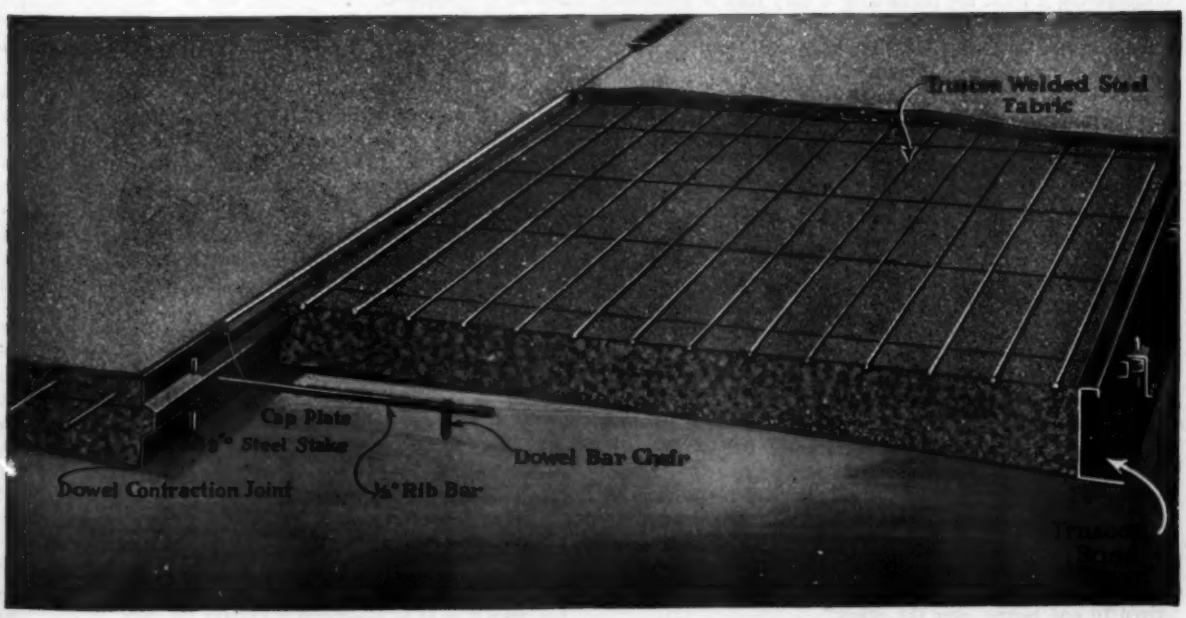


Surety Company Bond May Be Required on Public Work Unless Personal Surety Is Specially Provided for

Two road contracts were awarded by a Kansas county board to a construction company, on condition that bond be given "with a surety to be approved by the board." There was no statute, and nothing in the specifications or otherwise, specifying whether a personal surety might be furnished or not. The company tried to get a surety company to go on the bond, but could not, and the county board refused to accept a personal surety. The contracts were relet to the next lowest bidder at $20,000 more than the offer of the first bidder. The first bidder sued to recover a certified check for 5 per cent of the amount of its bid, but in an opinion filed February 9, 1929, the Kansas Supreme Court held that it could not be recovered; that the company had forfeited the deposit by failing to tender an acceptable bond. (Marquette Cravel & Construction Co. vs. Bengston, 274 Pac. 253.) The high spots of the court's opinion read:

"The appellant was not in any way misled by the failure of the public notice to specify the kind of bond required, but proceeded at once to endeavor to obtain a bond from a surety company, and the court finds it failed and was unable to furnish such a bond. In its bid it offered to 'secure a bond in the form prescribed by the board,' and 'with a surety to be approved by the board.' From these facts we can readily answer in the negative most of the claims of the appellant as to such a requirement being unfair, unreasonable, arbitrary, and capricious. Again, it is shown that the board consulted with the county attorney and the state highway engineer in reaching the conclusion as to the proper kind of bond to be required, and acted on their judgment in prescribing a surety company bond. Since the statute is silent as to this distinction, the board is justified in making a decision as to what in its judgment will be practicable and will safeguard the public interests. . . .

"The only difference between a surety company bond and a personal bond is one that concerns the sufficiency of the security; all other features of the bonds are alike. With each of them it is a question of the solvency of the sureties and their being able to respond in case of default. This includes not only financial worth above debts, exemptions, and liabilities, as stated in the findings as to the persons offered for security, but it also has reference to the question of having property subject to execution. The officers charged with the duty of approving or disapproving a bond are performing a duty that is discretionary, and such a duty that the courts will not compel them to act either way as far as the question of sufficiency or insufficiency is concerned. . . . The question of sufficiency of sureties calls for judgment of the approving officers just as does the question of responsibility of the bidder where the board is directed to select the lowest responsible bidder, and the action of the board in this respect should not be questioned unless it is arbitrary, oppressive, or fraudulent, and we find nothing along those lines in this case, either in the findings of the trial court or in the record of the case."

Unadvertised Award of Public Contract on Cost Plus Basis Held to Be Void

Where neither a notice inviting proposals to construct works in connection with a town sewage disposal system nor the specifications made provision for an award of the contract on a cost plus basis, such an award was invalid, declared the Iowa Supreme Court in the case of Chicago, Rock Island & Pacific Railway Co. vs. Town of Dysart, 223 N. W. 371, decided February 5, 1929. The court said, in part:

"Cost plus, under some circumstances, may be properly inserted in a contract [for public work] if the preliminary notice or specifications embody the same in order that all bidders may have that principle in mind when presenting their proposals. . . . Competition is thwarted if advantage is given to one bidder over the other."

General Contractor's Liability for Subcontractor's Acts

A decision handed down by the Michigan Supreme Court October 1, 1928, suggests at least one good reason for the exercise of care on the part of general contractors in the selection of subcontractors and the exercise of some degree of supervision over their work.

In the Michigan case—Wight vs. H. C. Christman Co., 221 N. W., 314—plaintiffs sued on account of damage to a house and its contents in a fire that they claimed was set by a steam-shovel used in excavating on an adjoining lot. Suit was brought against both the general contractor in charge of a building improvement on the adjoining lot and the subcontractor in charge of the excavation job. Trial of the suit ended in judgment in favor of the contractor and subcontractor, but, on appeal, the Supreme Court ordered a new trial on the ground that the trial judge had failed to correctly instruct the jury as to the law of the case.

As to the responsibility of a general contractor in a case of this kind, the Supreme Court said:

"The mere fact that Gohr [the excavating subcontractor] was an independent contractor would not excuse Christman [the general contractor] from liability. Where one owes a duty to another, he cannot acquit himself of liability by delegating performance of the duty to an independent contractor.

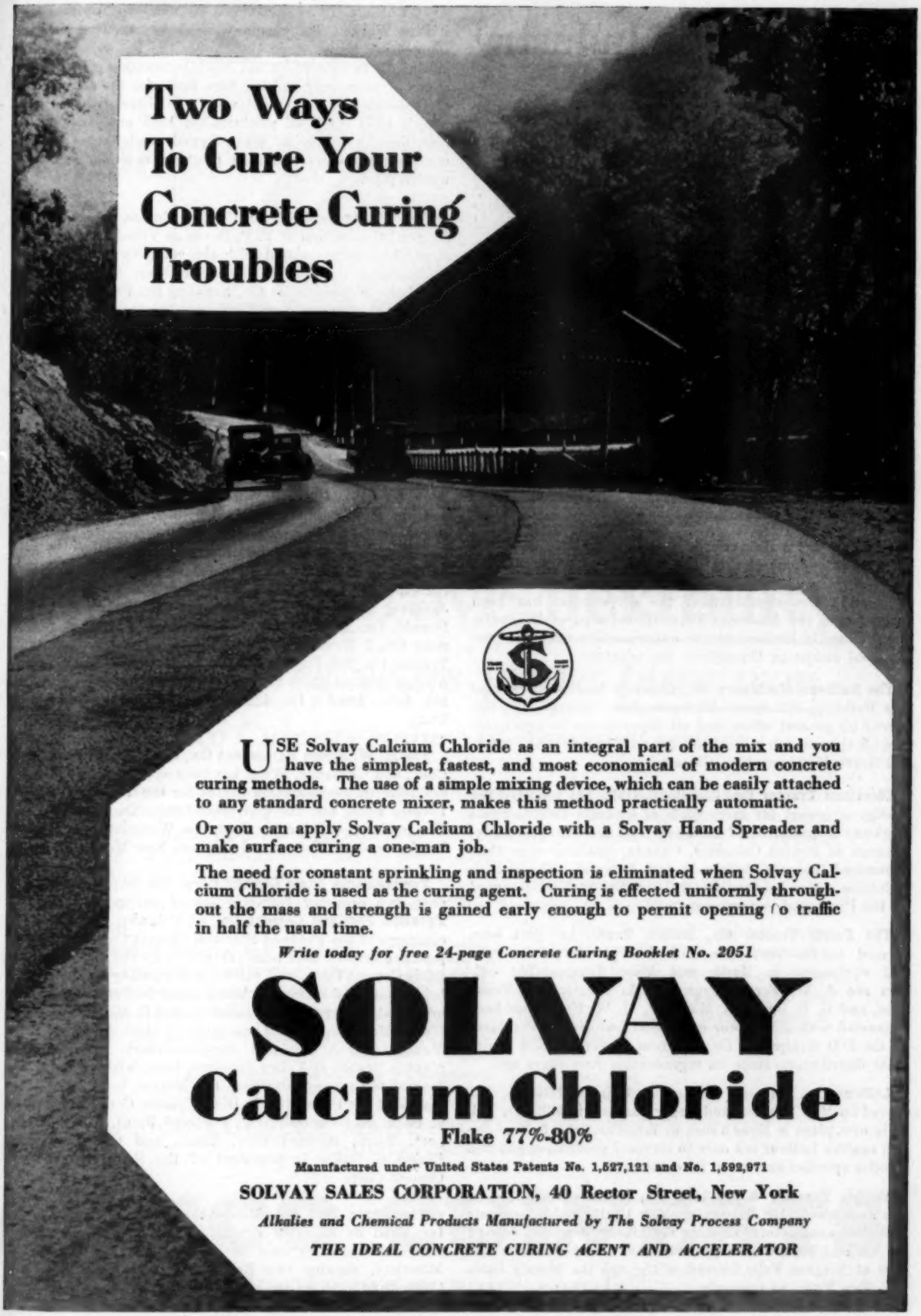
The Christman Co., was principal contractor for the erection of the building on the premises in question and cannot evade liability by the mere fact it hired Gohr to do excavating with a steam shovel. It was bound to see that the excavating, which as a part of its contract it was bound to do, was not done by a subcontractor in a negligent manner."

Legislature May Protect Subcontractors, Laborers, and Materialmen

A Mississippi statute prohibits an assignment by a general contractor of the proceeds of the contract to the detriment of subcontractors, journeymen, and materialmen, unless bond be given for their protection.

In the case of Hartford Accident & Indemnity Co. vs. Natchez Investment Co., 119 So. 366, decided by the Mississippi Supreme Court December 3, 1928, the validity of this law was attacked as unconstitutionally interfering with freedom in entering into private contracts. Overruling this objection, the court said:

"The contractor making a contract with subcontractors, journeymen, laborers, materialmen, has no constitutional right to be free from the obligation of paying them, nor has he the right to claim the proceeds derived from the builder [owner?] under his contract, free from the claim of the laborers, subcontractors, journeymen, and materialmen with whom he has contracted, and whose material or labor he has secured in the performance of his own contract. . . . We recognize the difference in the power of the Legislature to deal with contracts made by public bodies, such as the state, county, or municipality, or other agencies of the public, and the right to regulate contracts made between private individuals. In case of public bodies and public corporations, being agencies of the state, acting for its purposes, and having such powers only as the state confers upon them, the state has, in the absence of constitutional restriction, a plenary right to prescribe the terms and conditions of public contracts, or contracts of public boards, or municipalities, and parties dealing with such powers or agencies of the state deal with them in the light of the law giving them power and imposing restrictions upon their right of contract. But, in the case of individuals, the Legislature had no such plenary right. The citizen has the liberty of contracting, which cannot be entirely destroyed by the state, except in given circumstances deemed necessary for the protection of the public. In the case of private contracts, the Legislature can only impose reasonable regulations and restrictions, etc., and cannot entirely take away the right, nor deny it so as to substantially destroy the right."



Two Ways To Cure Your Concrete Curing Troubles

USE Solvay Calcium Chloride as an integral part of the mix and you have the simplest, fastest, and most economical of modern concrete curing methods. The use of a simple mixing device, which can be easily attached to any standard concrete mixer, makes this method practically automatic.

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The need for constant sprinkling and inspection is eliminated when Solvay Calcium Chloride is used as the curing agent. Curing is effected uniformly throughout the mass and strength is gained early enough to permit opening to traffic in half the usual time.

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THE IDEAL CONCRETE CURING AGENT AND ACCELERATOR

Construction Industry News

Truscon Steel Co., Youngstown, Ohio, has recently announced the transfer of R. A. Becker from the Credit Department of the Youngstown office to the Credit Department of the New Jersey branch where Mr. Becker will serve as Branch Credit Manager. The New Jersey office, which is located in Newark, is one of the largest of the 65 Truscon branches and handles a complete line of Standard steel buildings and building products in the state of New Jersey. C. D. Loveland is Branch Manager.

Manitowoc Engineering Works, Manitowoc, Wis., has announced the recent appointment of Contractors Equipment Co., Detroit, Mich., as representative for the sales and service of Moore Speedcranes, shovels, draglines, trenchhoes and Buffalo-Manitowoc clamshell buckets in the state of Michigan.

William H. Ahlers, Box 16, Kensington Station, Buffalo, N. Y., and the Chadwick Machinery Co., 25th and Clybourn Streets, Milwaukee, Wis., have also been appointed representatives for Manitowoc Engineering products.

Concrete Form-Hold Corp., Culver Bldg., Culver City, Calif., has announced that due to the growth of business and the extensive plans for additional manufacturing facilities and sales organization, the corporation has been merged with the American Form-Hold Corp., of Delaware. This change in business means a more active sales and promotional campaign throughout the country.

The Sullivan Machinery Co., formerly located at Peoples Gas Building, 122 South Michigan Ave., Chicago, Ill., has moved its general offices and all departments to new quarters on the seventh and eighth floors of the Wrigley Bldg., 400 North Michigan Ave., Chicago.

Cleveland Tractor Co., Cleveland, Ohio, has reported the receipt of orders for large fleets of Cletracs for the State Highway Department of Arkansas and the Provincial government of British Columbia, Canada, totalling more than a hundred thousand dollars in cash business. The British Columbia order brings the total number of Cletracs used by the Provincial government to 82.

The Ferris Tractor Co., Dallas, Texas, has just been formed to distribute the full line of United tractors and equipment in North and West Texas. The officers are J. W. Ferris, Pres.; F. A. Ferris, Vice-President, and H. L. Burleson, Manager. J. W. Ferris has been connected with the tractor equipment business as President of the F-D Equipment Co., Fordson implement and equipment distributors, since its organization four years ago.

LaBour Co., formerly located at Chicago Heights, Ill., moved on May 1 to new and larger quarters in Elkhart, Ind. This new plant is three times as large as their former one and enables LaBour not only to increase production but also to offer speedier service to its customers.

Dobbie Foundry & Machine Co., Niagara Falls, N. Y., has announced that, beginning May 1, all Dobbie products including contractors' hoisting machinery, derricks, derrick fittings and hand winches, will be sold direct from the factory at Niagara Falls instead of through the Mundy Sales Co., New York, as formerly.

The American Spiral Pipe Works, 14th St. and 48th Ave., Ave., Chicago, Ill., has changed its name to **Taylor Forge & Pipe Works.** The company which has been serving the engineering trades since 1900 under the old name remains unchanged in ownership and capital structure. The change is one of name only and has been made for the convenience of customers who were not wholly familiar with the company's wide range of products for high pressure service, including Taylor spiral pipe, forged steel flanges, forged nozzles for boilers and high pressure vessels and forged welded pipe.

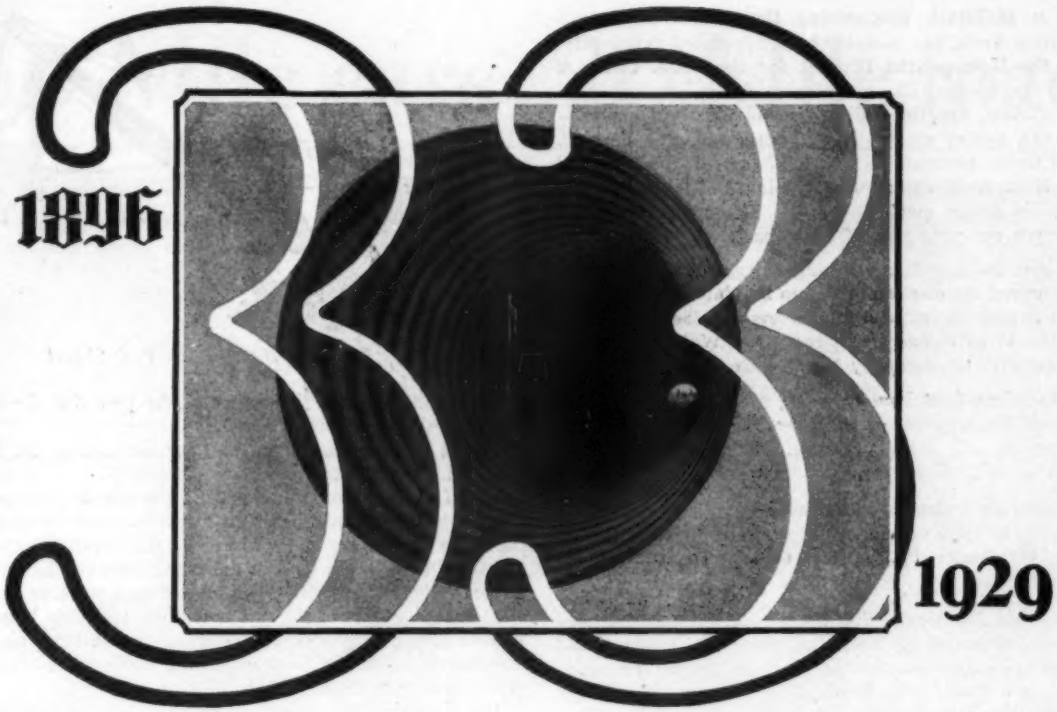
The Alexander Milburn Co., Baltimore, Md., has announced the election of E. P. Boyer as Vice-President. Mr. Boyer became associated with the company in 1919 as its Philadelphia District Manager. In May, 1926, he established the Milburn Sales Co., handling the Philadelphia territory, and later the New York and Chicago sales. Late in 1928 Mr. Boyer was elected Vice-President of the Milburn Sales Corp., and the Milburn Paint Spray Corp., which are the distributors for all the products of the Alexander Milburn Co. Mr. Boyer is spending a large part of his time at the Baltimore office of the company.

Novo Engine Co., Lansing, Mich., has announced the appointment of Clarence H. Buell, 404 South Clinton St., Syracuse, N. Y., as the Novo distributor for central New York State. Mr. Buell will carry the entire Novo contractors' line, including pumps, draglines, hoists and engines. Other Novo distributors who have been recently appointed include Jersey Contractors Equipment Co., 1020 W. 8th Street, Plainfield, N. J.; Fitzgerald & Hudson, 150 Nassau Street, New York; Fred Lemcke, Park and Liberty Avenue, Jackson, Mich.; Wylie Bros., Inc., Tulsa, Okla.; R. L. McDonald, Inc., Springfield, Mo.; Anderson Tractor & Equipment Co., 1 West Chapel Road, Biltmore, N. C.; Tennessee Tractor Co., 208 Fourth Avenue, S., Nashville, Tenn.; Mine & Smelter Equipment Co., 306-12 S. Seventh Avenue, Phoenix, Ariz.; Lund & Co., 425-8 Dooley Block, Salt Lake City, Utah.

The H. W. Moore Equipment Co., 120 Sixth Ave., Denver, Colo., and Cheyenne, Wyo., has been appointed sales representative in the Mountain States for the Thew Shovel Co., Lorain, Ohio, and the Universal Crane Co., Elyria, Ohio. The territory will include Colorado, Wyoming, western Nebraska, western Kansas and northern New Mexico.

Pennsylvania Dixie Cement Corp., has acquired the business and property formerly owned or operated by the **Pyramid Portland Cement Co.**, of Delaware. The existing contracts of the Pyramid Portland Cement Co., for Pyramid portland cement have been taken over by the Pennsylvania-Dixie Cement Corp., and will be performed by it, the cement being marketed under the brand name of Penn-Dixie. The organization personnel includes Conrad C. Miller, Manager; Hardy Magrath, Sales Manager; R. J. Hild, Assistant Sales Manager; R. A. Bechtold, Superintendent. The Pyramid plant is located at Valley Junction, Iowa, with offices at 531 Insurance Exchange Building, Des Moines, Iowa. The other plants of the Pennsylvania-Dixie Cement Corp., are located at Bath, Pa., Nazareth, Pa., Portland Point, N. Y., Kingsport, Tenn., Richard City, Tenn., and Clinchfield, Ga. Blaine S. Smith is president of the Pennsylvania-Dixie Cement Corp.

The Chain Belt Co., Milwaukee, Wis., has very kindly furnished us with the illustration which appears on the front cover of this issue of CONTRACTORS AND ENGINEERS MONTHLY, showing two Rex 14-S mixers working on the Cedar-Biddle Street Bridge, Milwaukee, Wis.



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twenty-three years prove pure iron

Armco Culverts endure in drainage service

IN 1896 the first corrugated culverts were put in service. Flexibility gave these black iron pipes their strength, pure iron gave them their durability. Today, after 33 years' use, 85 per cent of them are still in service.

In 1906 Armco Ingot Iron (the purest iron made) was first produced — to improve the uniformity of these first veterans. Today, 23 years of actual service testify to the durability of Armco Ingot Iron in drainage service. There has been no change in the analysis — no change in design since the first Armco Culvert was produced in 1906—*that* is significant to the buyer who wishes preproved durability in drainage structures.

"Look under your roads"

The durability in drainage service of Armco Ingot Iron is clearly written under America's roads. You can read this message in every state and province. Armco engineers will gladly assist you in making an actual investigation in your territory.

Armco culverts and drains are manufactured from the Armco Ingot Iron of The American Rolling Mill Company and always bear its brand

ARMCO CULVERT MANUFACTURERS ASSOCIATION
MIDDLETOWN, OHIO

ARMCO CULVERTS

"Look under your roads"

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Mott & McElrath Engineering Corp., 239 West 18th Street, New York, has recently been appointed representative in the Metropolitan District for the Orton Crane & Shovel Co., Chicago, Ill., manufacturers of crawling-tread cranes, shovels, draglines, ditchers and skimmers, locomotive cranes, gantry cranes, truck cranes and grab buckets. Sales of Orton products will be in charge of John Connell of the Mott & McElrath Engineering Corp., which will also service Orton machines in the Metropolitan district and carry a complete line of spare parts.

Link-Belt Co., 910 South Michigan Avenue, Chicago, Ill., has announced the election of James S. Watson to the office of Vice-President, with headquarters at the company's Dodge Works in Indianapolis, Ind. Mr. Watson has been associated with the company for 34 years.

The American Cast Iron Pipe Co., Birmingham, Ala., has announced the removal of its New York office from 165 Broadway to 117 Liberty Street. E. W. Herrmann is Manager of this office.

Pennsylvania Pump & Compressor Co., Easton, Pa., has announced the appointment of Carpenter & Byrne, 4 Smithfield St., Pittsburgh, Pa., as its sales representative in the Pittsburgh District.

H. O. Penn Machinery Co., New York, has discontinued its general offices at 18 East 41st Street, and established new and up-to-date quarters at the Port Morris Terminal, 140th St. and East River, Bronx, N. Y. The warehouse has also been moved to the same address and ample facilities are available for its increased business.

Industrial Brownhoist Corp., Cleveland, Ohio, has purchased the McMyler-Interstate Co., Bedford, Ohio. The McMyler plant, machinery and materials are not included in the purchase but manufacturing operations and the business of the McMyler Co., together with all drawings and records are to be moved to the Cleveland plant of the corporation. Industrial Brownhoist was the original builder of locomotive cranes in this country and its products now include a complete line of these cranes, as well as crawler shovels, pile drivers, bridge cranes and other types of material handling machinery with plants located at Cleveland, Ohio, Bay City, Mich., and Elyria, Ohio.

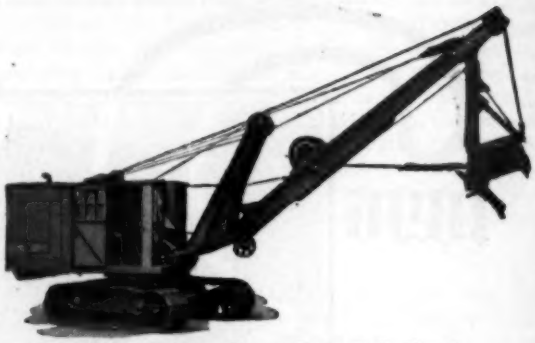
The Foote Co., Inc., Nunda, N. Y., manufacturers of Multi-Foote road pavers, has elected F. L. Dake, formerly Secretary-Treasurer, as its President and Secretary of the new organization and R. E. Brooks, Vice-President and Treasurer. C. E. Foote and H. M. Foote, formerly President and Vice-President, are retiring.

The Jaeger Machine Co., 701 Dublin Avenue, Columbus, Ohio, has announced the appointment of the Southern States Equipment Co., New Orleans, La., McLaughlin Mill Supply Co., Hammond, Ind., and R. W. Simpson Co., Cedar Rapids, Ia., as distributors of Jaeger products.

A New Heavy Duty Pull Shovel

A NEW heavy duty pull shovel has been added to the line of excavating equipment manufactured by the Koehring Co., Milwaukee, Wis. Among the outstanding features of this shovel are the shock absorbing principle in the boom base and in the dipper stick and a specially designed jib frame.

The boom shock absorber is identical with that used on the Koehring shovel and in the same manner takes the twisting strains out of the boom and cushions the dipper when trimming the sides of a sewer trench. The dipper stick unit adds power to the digging effort by producing a gnawing action in hard, tough digging through the action of the powerful shock absorbing spring upon the dipper.



The Koehring Heavy-Duty Pull Shovel

Instead of being hinged to the turntable casting, the boom is hinged to a separate casting which forms the base of the jib frame. The hinge point on all machines in 6 inches beyond the end of the multiplanes. This provides clearance for lowering the boom and dipper so as to dig its full depth close up to the machine, with the ends of the multiplanes resting on solid ground. This hinge point can be raised to a working position from 1 foot 9 inches to 2 feet above the turntable hinge pin sockets, giving a high dumping clearance, or the hinge pin may be lowered below the level of the turntable sockets to provide a maximum digging depth.

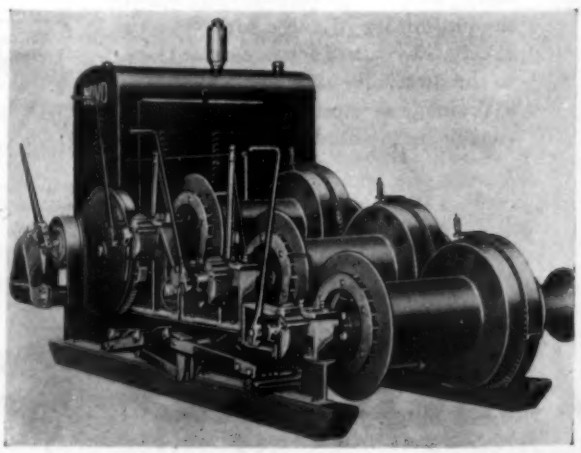
The Koehring pull shovel is built in two sizes, equipped with ⅞ and 1¼-cubic yard dippers and has a digging depth of from 17 to 24 feet.

A 3½-Ton Hoist

A NEW hoist known as the WH has just been announced by the Novo Engine Co., Lansing, Mich., and is designed to handle loads up to 3½ tons. The standard line speed is 250 feet per minute with greater loads being handled at lower speeds. A special high speed one-drum hoist is included in the series which has a line speed of 480 and 520 feet per minute and a load capacity of 1,500, 2,300 and 2,700 pounds. The regular hoists are manufactured in 1, 2 and 3 drum units.

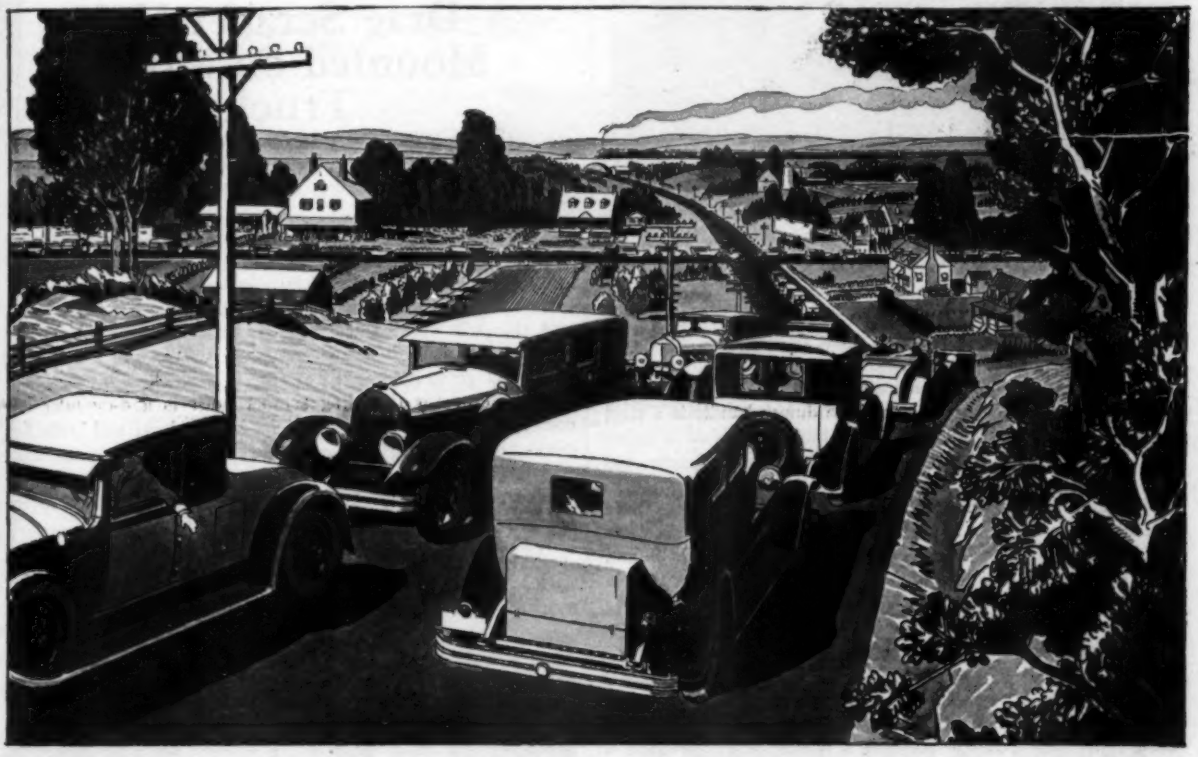
Novite, a new alloy developed by the Novo Engine Co., is used in the construction of these hoists. It is stated that this metal has a transverse strength 80 to 100 per cent more than cast iron and wears 4 to 6 times as long as semi-steel.

Danger of base warping and the gears and bearings constantly twisting from the line is eliminated by using the Novo all-welded steel base.



The New Novo Three-Drum Hoist Powered with a 50-Horsepower 4-Cylinder Engine

60-Mile cars..20-Mile roads



A TRAFFIC-CLOGGED road is a 20-mile road, at best. No laws can change that. If our 60-mile-an-hour cars are ever going to do even 40 as dependable running time, more roads and wider roads are the only possible solution.

Tarvia "Re-Tread" furnishes a logical answer to a large part of the necessary expansion program. As acquaintance with "Re-Tread" grows it is bound to occupy an important place in the thinking and planning of every highway official.

With "Re-Tread" old, worn-out roads can be transformed into smooth, easy-riding, skid-safe highways, and new roads built—quickly, easily. No special equipment is needed and the road can be kept open during the whole process of construction. Costs are impressively low, results uniformly satisfactory. A Tarvia "Re-Tread" road will compare favorably with much more expensive pavements.

The Tarvia field man will gladly tell you more about "Re-Tread." Write, wire or 'phone our nearest office.

The Barrett Company

New York	Chicago	Philadelphia
St. Louis	Minneapolis	Boston
Detroit	Cleveland	Birmingham
Buffalo	Kansas City	Columbus
Providence	Syracuse	Milwaukee
Baltimore	Toledo	Cincinnati
Lebanon	Youngstown	Rochester
		Bethlehem

In Canada:
THE BARRETT COMPANY, Ltd.
Montreal, Toronto, Winnipeg, Vancouver

Tarvia "RE-TREAD"

TRADE MARK REG. U. S. PAT. OFF.

The Bucyrus-Erie Drag Shovel Ready to Dump

A Diesel Drag Shovel

THE new diesel convertible drag shovel, manufactured by the Bucyrus-Erie Co., South Milwaukee, Wis., may be used as a shovel, dragline, crane or clamshell and operates with low fuel cost.

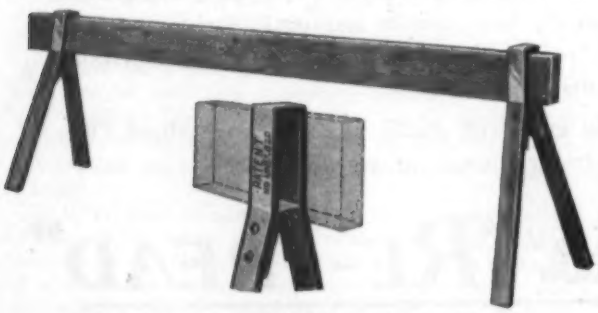
The machine is built simply and ruggedly. The boom is of latticed channel construction while the dipper handle is a steel casting of I-beam section. The dipper, built with an extra heavy arch to take the thrust of the boom and dipper handle, has long, chisel-shaped reversible teeth held in wedge-shaped sockets without bolts or rivets. It is made with a marked flare to make it easier for the operator to cut a smooth wall and to cut the time required for dumping. Both hinged bottom and solid dippers are available in sizes suited to several widths of trench.

With standard 24-foot boom and 8-foot 6-inch dipper handles, the machine has a maximum digging depth of 21 feet and a digging radius of 36 feet 6 inches. The clear dumping height for a front opening dipper is 19 feet 3 inches. The minimum dumping reach of the same dipper is 19 feet 6 inches while the solid type dipper dumps between a radius of 17 feet and a radius of 30 feet.

Steel Barricade Supports

THE mortality of wooden horses and barricades is very high. They are almost always made in a slipshod manner because the job is given to any laborer who can drive a few nails and wield a saw. The Cleveland Steel Specialty Corp., 6600 Park Ave., Cleveland, Ohio, has developed a steel barricade support which will outlast literally hundreds of wooden horses and still be good for years to come. These riveted steel supports are made sufficiently heavy to resist high wind pressure when supporting the horizontal 2 x 6 stringer at a height of 30 inches from the ground. Two supports and the stringer can be assembled, dismantled and easily handled by one man.

The supports are self-locking, rigidly constructed and do not wobble. They can be bent, but will not break and a few blows with a hammer will straighten them out. Very little storage space is required for this support and they can be stored very economically. The supports are painted a bright red with a lasting paint which is seen at a considerable distance, is a distinct warning in itself and also protects the metal work from rust.



Self-Locking Steel Barricade for Construction Work

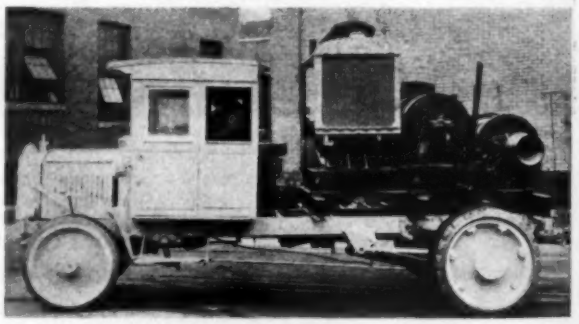
A Drag Scraper Hoist Mounted on Motor Truck

A TWO-SPEED drag scraper gasoline hoist designed for any kind of drag scraper work within its capacity has been announced by the American Hoist & Derrick Co., St. Paul, Minn.

This hoist, which weighs 8,140 pounds has larger shafts, machined drums, enclosed accessible silent chain drive running in oil, large diameter American cool running, expansive frictions that will start all loads easily, large long wearing brakes, and thorough lubrication. The front or digging drum will hold 1,000 feet of 5/8-inch rope while the rear or high speed drum will accommodate 1,250 feet of 1/2-inch rope.

The motor for this drag scraper hoist is a 4-cylinder 60-horsepower Waukesha engine. The friction lever and brake are connected to the same banked lever so that when the friction is engaged the brake is automatically released and when the brake is engaged the friction is released. Banked levers are arranged so that the operator faces the work.

When the hoist is to be mounted on a motor truck, as shown in the illustration, a special mounting of 8-inch I-beams in 7-foot lengths is supplied.



The American Two-Speed Drag Scraper Hoist Mounted on a Truck

Additions to Line of Protective Paints

SEVERAL important changes have been made in the line of protective paints which have been manufactured by the Joseph Dixon Crucible Co., Jersey City, N. J., for more than 65 years. Dixon's industrial paint, known as Dixon's silica-graphite paint, has been increased in range of colors from 8 to 14 colors which includes a straight aluminum paint and also a standard red oxide paint. This color range meets more completely all standard color requirements for metal and wood protective coatings. The bright aluminum paint contains a durable spar varnish as its vehicle, giving great resistance to the elements and insuring the life and brilliancy of the pigment.

Dixon's utility paints have been added as standards, three of which are graphite-pigmented, the fourth, oxide of iron. Dixon's maintenance floor paints have been developed for the protection of wood, composition, linoleum, cement and concrete floors. They are immune to the action of alkali and are particularly adapted for cement and concrete floor coatings. They may be used inside or out, will withstand weather and climatic changes and are made in eight standard colors.

ALBAN TRACTOR CO., INC.

"CATERPILLAR" TRACTORS EQUIPMENT

831-33 EAST 25th STREET
BALTIMORE, MD.
TELEPHONE HOMEWOOD 888

ROAD MACHINERY
CONSTRUCTION EQUIPMENT
SNOW PLOWS

April 19th 1929.

The Creeper Wheel Company.
Colonial Trust Building.
Reading, Pa.

Gentlemen:-

Answering your recent inquiry we wish to advise that the CREEPER WHEEL equipment sold by us about 14 months ago is still in successful operation and the cost of repairs has been practically nothing.

The contractors who purchased this equipment are enthusiastic about it and due to the satisfactory work performed we were able to sell additional equipment this spring and have more orders in prospect.

This CREEPER WHEEL equipment was sold by us only after a very careful investigation of similar equipment, which investigation convinced us that CREEPER WHEEL equipment was the best on the market.

Very truly yours.

ALBAN TRACTOR COMPANY, INC.

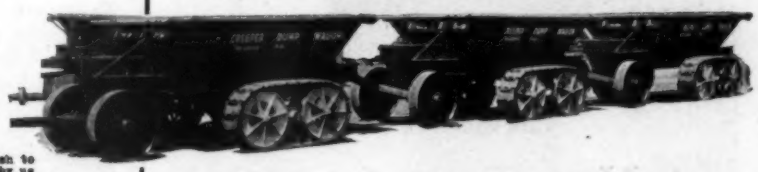
James C. Alban
President.

JCA/t

HERE THEY ARE!

THREE MORE

CREEPER WHEEL Equipped Wagons



SHIPPED TO ALBAN TRACTOR CO.

Since receiving the letter at the left, we have made the above shipment. Below are a few of the reasons extracted from Mr. Alban's letter explaining why *repeat orders* are so frequently received from owners of CREEPER WHEEL-Equipped wagons, trucks, trailers, etc.:

"CREEPER WHEEL equipment sold by us about 14 months ago is *still in successful operation.*"

"*cost of repairs* has been *practically nothing.*"

"contractors who purchased . . . are *enthusiastic.*"

"due to the *satisfactory work performed*, we were able to sell additional equipment this spring and have more orders in prospect."

Write today for illustrated booklet

THE CREEPER WHEEL COMPANY

602 Colonial Trust Building **Reading, Pennsylvania**

"3-C" Calcium Chloride is easily applied, as illustrated above, by simply attaching a spreader box to a truck. The Calcium Chloride is carried in handy 100-lb. bags on the truck and dumped into the spreader.

Preventing Dust the Modern Way!

"3-C" CALCIUM CHLORIDE offers dustless gravel roads at very small expense. It also helps keep the road in better condition, lowering maintenance cost.

"3-C" Calcium Chloride is a pure granular chemical, clean and odorless. It absorbs more than twice its own weight in moisture. Spread upon the road it keeps the surface moist and dust free.

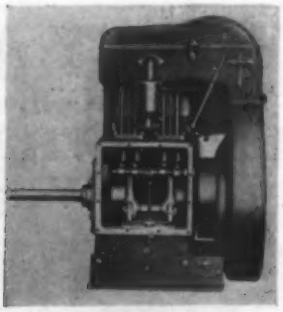
Write today for complete information concerning the efficiency of "3-C" Calcium Chloride in combating the dust nuisance.

THE COLUMBIA PRODUCTS CO.
BARBERTON, OHIO

"3-C" Calcium Chloride is manufactured by the Columbia Chemical Division, Pittsburgh Plate Glass Company in their plants at Barberton and sold exclusively by The Columbia Products Company and their distributors.

3
COLUMBIA
CALCIUM
CHLORIDE
77 - 80%
TRADE MARK

The Columbia Products Co.,
Barberton, Ohio.
Please send complete information about the advantages of "3-C" Calcium Chloride for dust prevention.
Name.....
Street.....
City.....



The New-Way Air-Cooled Twin Cylinder Engine

A New Twin 6 to 10-Horsepower Engine

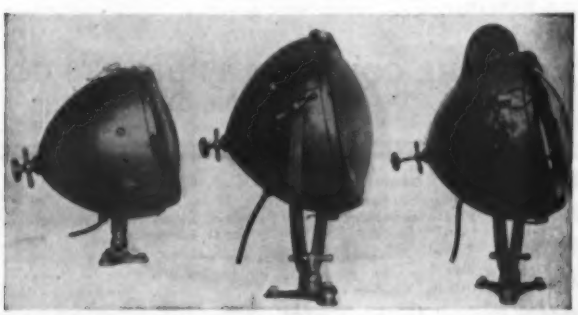
A NEW air-cooled twin-cylinder 6 to 10-horsepower engine has recently been developed by the New-Way Motor Co., Lansing, Mich. This new engine is a result of twenty-three years of experience with air-cooled engines. It is simple in construction, with no water pipes, radiator fins, or other parts necessary to water cooling. It is a valve-in-head type, with detachable cylinder head. A large inspection plate may be removed, exposing all moving parts and through which the pistons may be removed and replaced with ease. Roller bearings, air-governor, Eisemann special flywheel magneto, Tillotson float feed carburetor and air cleaner and Lynite connecting rods are standard equipment.

The system of cooling is the same as that employed on the other New-Way air-cooled engines. The flywheel is provided with a series of curved blower blades around its periphery, and as it turns it creates a partial vacuum in the wheel housing. The strong suction effect draws air in and down through the cylinder jackets. The air currents pass over and between the flanges at fairly high velocity, and as there is a large amount of exposed surface, the excess heat is promptly disposed of, being absorbed by air passing around the cylinders, which is ejected from the motor compartment by the action of the blower flywheel.

This type of engine is particularly adaptable to jobs where it is difficult to secure water, where the engine is subjected to extreme heat or cold, and where light weight is a factor.

New Floodlighting Projectors

A NEW line of floodlighting projectors of interest to engineers and contractors, and which may be used for lighting buildings, yards, docks, bridges, night construction work and the similar purposes has recently been announced by the General Electric Co., Schenectady, N. Y.

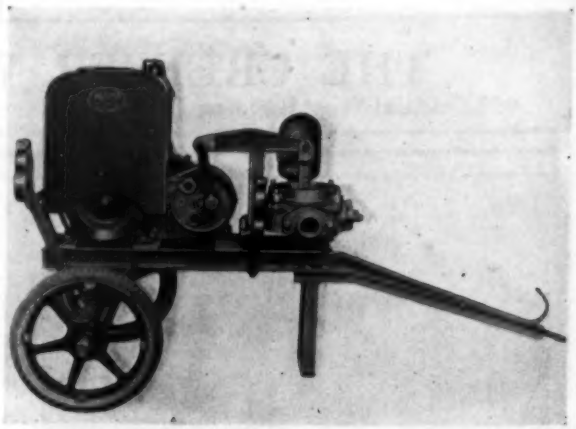


Three New Forms of General Electric Floodlighting Projectors for 250, 500 and 1,000-Watt Lamps

The projectors have non-ferrous, and therefore, non-rusting casings, and the glass reflectors and lamps are totally enclosed so that dirt and dust can not enter or impair their efficiency. Since the casing is non-ferrous, good heat radiations and minimum dimensions of design are afforded and the units are light in weight. Ease and accuracy in focusing are attained through the use of unique universal focusing mechanisms. A small three-point base design and swivel give simple mounting, with ease of installation and orientation of the flood light beam.

Th projectors are built with a formed, single piece sheet copper casing and a single-piece door of the same material. The rear of the casing is hemispherical, and is provided with a clearance hole for the socket-holder rod of bronze which is part of the focusing mechanism. The lens is held loosely within the door by means of punched supports and screw clamps, fitted with asbestos cushions to prevent breakage. The focusing mechanism is universally adjustable, consisting of a clamping chuck or collett similar to that used on lathes.

Two sizes of lenses are available, the clear lenses with plain, lightly rippled, heavily rippled or spread light distribution. The colored lenses are supplied with plain or heavily rippled distribution. All lenses are of heat-resisting glass. For projectors equipped with clear lenses, color plates of red, amber, green or blue are available. Where projectors are mounted close to the base of the surface to be illuminated, most efficient illumination is afforded by the combination of a new asymmetric reflector and spreadlight lens. The reflectors are of silver-plated glass, protected by copper backing.



The Novo 21-C Closed Top Single Diaphragm Pump Mounted on a Two-Wheel Trailer

A New Diaphragm Pump

A NEW diaphragm pump, known as the No. 21-C, which has been built particularly for use in de-watering manholes, tunnels, sewers, excavations, and in emergency work, is manufactured by the Novo Engine Co., 216 Porter Street, Lansing, Mich. This pump is built with a closed top so that water can be delivered some distance away from the manhole or excavation. Cleaning out any debris and changing the diaphragm can be easily and quickly accomplished. A worn out diaphragm may be removed and a new one installed in less than 3 minutes.

All working parts of the engine and back gearing are entirely enclosed and self oiling. The pump is mounted on rubber-tired trailers to facilitate transportation, a special feature of this being the coil spring mounting. Coil springs between the frame and axle absorb the road shocks and make possible faster speed even over rough roads.

The capacity of the Novo 21-C ranges from 4,000 to 5,000 gallons per hour with a suction lift of 20 feet and a total head of 50 feet.

It's a "WOW"—

That's what contractors everywhere are saying about the

New Improved

BROOKVILLE LOCOMOTIVES

(McCormick-Deering—International Power Units)

They have made and saved thousands of dollars for thousands of contractors, through furnishing—

INCREASED TRACTION ON RAILS Guaranteeing the completion of job in advance of schedule with—

ELIMINATION OF DELAYS through breakdown, repairs, weather conditions, and by

ADDED ECONOMIES through substitution of DEPENDABLE STRENGTH for uncertain man power.

The **BROOKVILLE**

can help you land that next job—
or speed up the present one—
and we'll be happy to place
our experience at your disposal
—if you'll let us.

Write today and tell us about your individual problem—our recommendations together with the latest BROOKVILLE literature will follow by mail.

BROOKVILLE Locomotives are supplied in standard, wide and narrow gauge in 4, 5, 6, 8, 10 and 12 ton models. They are powered by McCormick-Deering—International Power Units—and are adapted to your requirements.

BROOKVILLE LOCOMOTIVE CO.
Brookville, Pa.

A Two-way SAVING

on Box Sewers and Storm Drains

Note the clean side walls on this box-sewer trench, being dug by the Parsons 31 for the Mann Construction Company, Oklahoma City. The trench is eleven feet wide, and the 31 handles it in three cuts.

EXTRA-WIDE jobs that used to be considered "too big for any excavator" are now being dug at lower cost than ever before with the Parsons 31.

How? Here's the answer—Mobility. The Parsons 31 is the only big excavator with full-crawler traction. Put it on a big box-sewer job, and it takes the dirt in parallel cuts—a type of digging that is possible only because the Parsons 31 can step so quickly from one cut, over to the next.

Engineers know that an excavator is the most economical way of getting dirt out of a trench. And the Parsons 31 gives an added saving because it leaves a clean sidewall, so essential in box-sewer work.

Since it digs at either side or in the center, the Parsons 31 works to equal advantage on small jobs in close quarters.

Send coupon for complete details of this remarkable all-around machine.

THE PARSONS COMPANY
NEWTON, IOWA
Division of National Equipment Corporation

PARSONS

A complete line of trenchers and backfillers

THE PARSONS COMPANY, NEWTON, IOWA
CE-5

Please send full details and specifications of your big full-crawler trencher—the Parsons 31—to this address

NAME.....
ADDRESS.....
CITY.....

The Barrymore Truck-Mounted Concrete Mixer

A Concrete Mixer Mounted on a Motor Truck

A CONCRETE mixer for mounting on motor trucks is manufactured by the Barrymore Corp., 1066 Union Trust Bldg., Cleveland, Ohio and is known as Trukmixd. These Barrymore mixers are a combination of a concrete mixer and an open top truck dump body which easily loads and unloads, is easy to clean and is a double utility unit as it can haul sand and gravel separately or haul and mix concrete. The power for operating the mixer is taken from the motor through a proper reduction gear. The mixing is done after the truck arrives at the job so the motor is not subjected to undue strain nor is the speed retarded by taking power in transit. These Barrymores can be mounted on any standard truck having a proper power take-off.

All materials and water going into the concrete are accurately measured. The water is kept separate until mixing at the job just before dumping, thus insuring a freshly mixed conlar consistency in the concrete.

A New Sewer Pipe Joint Material

AN asphaltic product for making leak proof sewer pipe joints has been developed by the Standard Oil Co. of Indiana, 910 South Michigan Ave., Chicago, Ill., under the trade name No. 1 Korite. No. 1 Korite is said to make a permanent tight joint and to prevent the leakage, infiltration and choking of pipes by roots. The material can be chopped up and melted in a suitable kettle at a temperature from 250 to 350 degrees Fahrenheit, according to weather conditions, but the lowest temperature possible to pour the joint properly is recommended.

Before making the joints the outside of the spigot on the end of the pipe and the inside of the bell of the pipe are swabbed or brushed with a thin coating of hot Korite which is allowed to stand for approximately 15 minutes until the Korite sets or hardens. The pipe is then lowered into the trench and put together and laid in the usual manner. Oakum is carefully and tightly calked in the space of the joints, leaving at least 1½ inches open space for sealing with the joint material. A joint runner made of asbestos rope or the standard water pipe joiners can be used. If the joint runner is lightly swabbed with kerosene, a lubricating oil or with grease the oil coating will prevent the hot Korite from sticking to the runner.

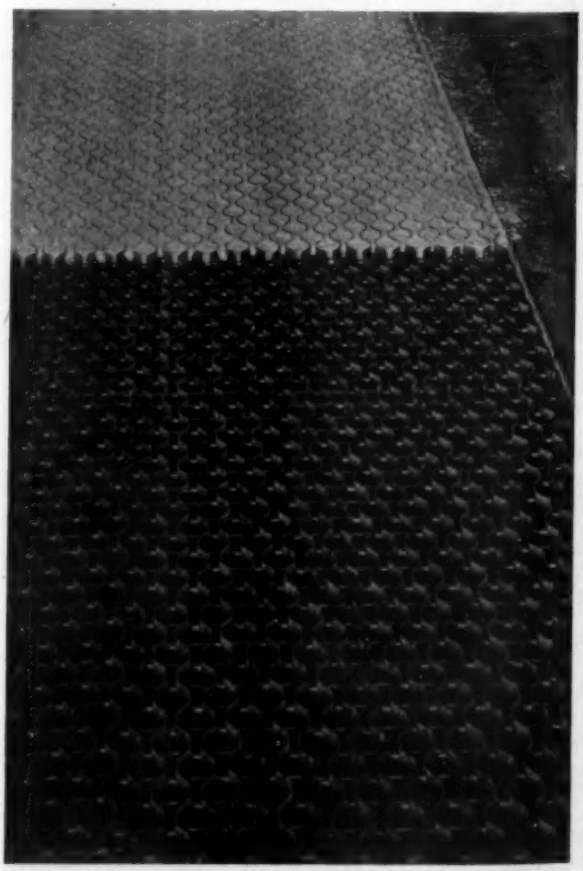
In making the joints, considerable care must be used in adjusting the joint runner around the pipe. It should be tight at the bell of the pipe so that the hot material will not run through to the ground and be lost or wasted. After the runner is adjusted the junction between the pipe and the runner can be made tight by smearing the joint between the joint and the runner with moist clay which must not be allowed to get into the joint that is being poured nor to come in contact with the stream of hot Korite, as this will cause foaming and result in an ineffective joint. This joint material cools in about 15 minutes, after which the joint runner can be removed.

No. 1 Korite is put up in light metal cylindrical drums containing approximately 400 pounds each and is shipped from Whiting, Ind., Wood River, Ill., Sugar Creek, Mo., and from Caspar, Wyo., refineries.

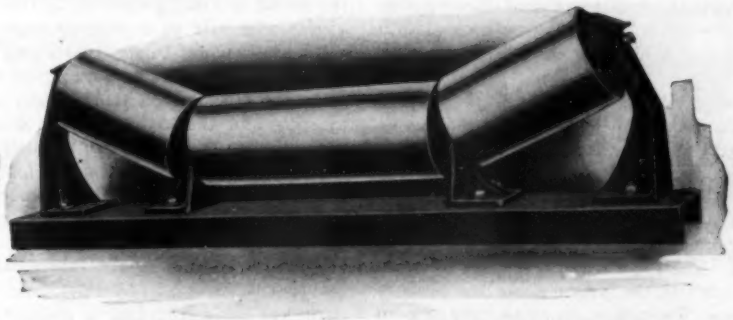
A New Steel Armoring for Floors

THERE has been a growing dissatisfaction with floors of factories, terminals, shops, show rooms and other places where a floor is required to handle heavy service because, no matter how well built, they break down under the usage which they receive. There is now, however, a new product for steel armoring concrete, asphalt and composition floors so that the surface will be as strong as any part of the floor and the life of the floor will therefore be prolonged. This material is called Floorgard and is manufactured by Blaw-Knox Co., 667 Farmers Bank Bldg., Pittsburgh, Pa.

Floorgard is a built-up continuous steel mat that is laid down to form the surface of the floor, and is so designed as to present to traffic such a surface that the stresses will be taken care of by the steel itself, distributing loads through a



The Blaw-Knox Floorgard for Steel Armoring Concrete, Asphalt or Composition Floors



THESE ARE SUPER-CONWEIGH THREE-PULLEY TROUGHING IDLERS

WITH OUTBOARD BRACKETS

We were the designers and builders of the conveyors used for constructing the concrete anchorage on the New York side of the Hudson River Bridge, which is to have a span twice as long as that of any other bridge in the world.

The idlers illustrated have malleable iron outboard brackets; Alemite lubrication. They are equipped with either Timken roller bearings or S. R. B. ball bearings.

We are the original designers of ball-bearing idlers.

THE CONVEYING WEIGHER COMPANY

90 WEST STREET **NEW YORK**

Taking a 1½-yd. bite with a Model D Scraper*

BAKER MANEY Self Loading Scrapers

With a train of four Baker Maney Model "D" Scrapers you can load and haul 6 yards of dirt to the dump every trip. The Baker Maney train method is the accepted earth-moving outfit for hauls under 1000 feet.

Contractors and road officials are adopting Baker Maneys because of their large capacity, easy operation with few men, short turning and big yardages. The "original self-loading scrapers" will simplify your job and reduce your earth moving costs.

Larger Capacity

Four Wide Wheels

Full Turn on 20-Foot Fill

Stronger Than Ever

Big Daily Yardage

2 to 3 Men "Gang"

Smoother Grades

** Also made in ¾- and 1-yard capacities*

The Baker Mfg. Co. 585 Stanford Ave., Springfield, Ill.

EQUIPMENT FOR EARTH MOVING AND ROAD MAINTENANCE

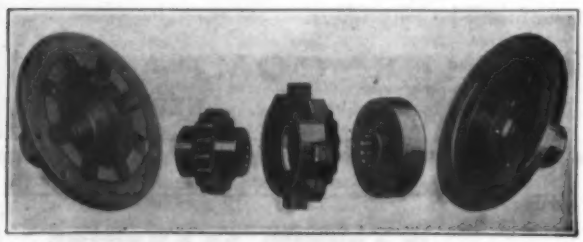
Send for Bulletins on | Baker Maney Scrapers ☐ Baker Rotary Scrapers ☐ Baker Road Maintainers ☐ Baker Bulldozers ☐

wide area of floor. It also is so designed that the concrete appearing between the steel bars is in no way divided into separate portions but is monolithic with the rest of the concrete forming the floor body.

It consists of a number of steel strips carefully shaped into a regular pattern which when placed together form a series of separate rectangles of proper size. These steel strips are set on edge, as shown in the illustration. Small, circular tie rods are inserted in a horizontal position through holes in the middle of the strips. These tie rods act as carrying members, carrying one strip to another strip, as well as tying the entire surface into one steel mat. There are small steel lugs between adjacent strips of Floorgard at the points where the tie rods go through the steel strips. These lugs act as anchors to keep the steel strips in the plastic material and also as separators between the strips, avoiding any possibility of rust due to contact of the steel.

Floorgard is very easily installed and requires no drawings or special tools. Where it is not necessary to reinforce the entire floor, Floorgard may be used in the aisles or runways where the traffic and points of wear are greatest. It is easily cut and fitted around bases, columns or other obstructions. It is made in various sizes of mesh to conform to varying conditions and requirements of service.

Under the name Pavegard, a similar steel armoring is made for use in strengthening the surface of roads, streets, bridges and other forms of pavements ordinarily subjected to unusually hard wear.



Dissembled View of Krohn Differential Used on Mack A-C Trucks, Showing the Three Moving Parts and the Two Halves of the Case

A New Type of Differential

THE true function of a differential is to compensate for the difference in rotative speeds and tractive ability between the driving wheels of a power driven vehicle. It should transmit equal power to both driving wheels regardless of their respective rotative speeds and proportional to their respective tractive ability. If one wheel runs slower or faster than the other, it must, nevertheless, receive the same amount of power and, if one of the wheels has better road adhesion or traction than the other one, it should receive power in direct proportion to its traction.

The usual differential permits the power of the engine to go to the wheel which turns the easiest, and in the case of fast driving over uneven roads, it will tend to speed up the wheel which is off the ground momentarily, thus causing unnecessary tire wear when this wheel goes down on the ground again and has to slow down to the speed of the other wheel. Consequently, the ordinary differential does not compensate for the difference in tractive ability between the driving wheels.

The standard bevel gear differential is not wrong fundamentally, but it seems that it falls short in its function as it does not go far enough. The Krohn differential, made by the Krohn Differential Corp., 209 South La Salle St., Chicago, Ill., compensates for the difference in rotative speed between the driving wheels when turning corners or when there is a difference in tire diameters. It also compensates for the difference in tractive ability between the wheels in such a way that the power of the engine is distributed or divided between the wheels in exact proportion to their tractive ability. If one of the wheels is on a slippery road surface, it may require just enough power to start it turning before the car begins to move, but as it tends to increase its speed, enough power will go to the other wheels to help start the car. In other words, the power of the engine will be delivered to both wheels in proportion to their ability to use it in propelling the car. The Krohn differential compensates for the difference in rotative as well as tractive ability between the driving wheels.

This differential takes the place of the ordinary differential with no other change whatsoever in the rear end assembly. It operates because of the compensating action of the series of eccentrically meshed internal and external gears and it is positively not self-locking in operation. Because of the compensating action of the Krohn differential, the braking power of the brake is distributed to the wheels in the proper proportion with the result that braking power becomes effective even with uneven braking surfaces. When a vehicle is rounding a corner, the Krohn differential permits one wheel to rotate faster than the other, just as with the differential of conventional design. This new type differential has but three simple moving parts in addition to the two halves of the case.

Protection for Steel Against Rust and Corrosion

ARCHITECTS, hydraulic engineers, contractors and builders are realizing more and more the necessity of protecting and preserving structural and submerged steel from rust and corrosion which will eat into the best steel and eventually destroy its usefulness.

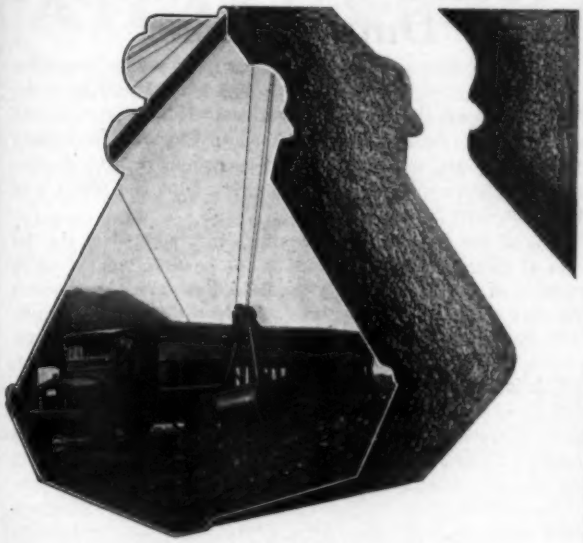
The Semet-Solvay Co., 61 Broadway, New York, has developed two paints, Semet-Solvay Hydraulic and Semet-Solvay Multiproof paints, which assure permanent and complete protection against the effects of alkalies, free lime, and other powerful destructive elements contained in cement and many kinds of water which eat their way into steel beams and girders. The manufacturers state that one coat of this protective paint, the only difference between the two kinds of paint being that Multiproof is thinner for cold weather painting, endures for a long period and saves steel which otherwise would become corroded and useless.

A Stop Watch for Accurate Timing

TIME is an exceedingly valuable element in the building and construction industry and wasted time usually means financial loss. Accurate timing of the concrete mixer, checking pumps for valve condition, timing conveyors and machinery to discover lost motion, loss of time and so forth in the performance of equipment may be of great importance in the conduct of a business.

The Sterling Stop Watch Co., Department C, 15 East 26th Street, New York, manufactures a combination watch and stop watch which is particularly designed for use of this kind. It is accurate and durable with a nickle finish and unbreakable crystal. These watches are designed to withstand the hard use to which they might be subjected in this type of service, and should prove an aid to efficiency on every job in the building or construction fields.

The Sterling Combination Watch and Stop Watch



"Saves us 1/4 to 1/3 in digging time"

Let us send you the full report from J. A. Crawford of Blossburg, Pa.—and reports from other contractors who are *getting larger output from their cranes* by using WILLIAMS Buckets.

The bigger outputs that users report will give an idea of what *you* can expect from the WILLIAMS.

The fastest bucket built keeps your crane speeded up

The WILLIAMS Power-Arm combination of lever and block-and-tackle builds up a greater digging power *faster*—using a shorter cable overhaul. And does this in the one way that gives a *straight line* closing pull. Faster opening and closing—more trips per hour.

And the bucket we put on your work is guaranteed for Durability, as well as Output —"*Built to Dig, and Last While Digging.*"

Write for our Bucket Bulletin C, showing the new WILLIAMS "Champion" line of super-buckets.

G. H. WILLIAMS COMPANY

609 Haybarger Lane, Erie, Pa.

Branch Offices: New York, Pittsburgh, Chicago

WILLIAMS
FAST-DIGGING BUCKETS

BUY BOSS MIXERS and HOISTS DIRECT FROM FACTORY

YOU GET SALESMAN'S & JOBBER'S PROFIT!

SAVE $42 to over $384 ON EACH MACHINE

Every manufacturer is trying to reduce his selling costs. We have found the way and are going to give the difference to our customers in order to increase our sales. We have done away with all our salesmen and jobbers and are now selling direct to users. We have deducted the salesman's and jobber's commission from each machine and the difference is our price to you. This is the most astonishing news in the construction industry and it is certainly paying us as sales are jumping by leaps and bounds. Get the new catalogue with new confidential wholesale prices on each machine. It shows the most popular types and combinations, describing each fully—with new price. The coupon will bring it.

SAME HIGH QUALITY

Regardless of this drastic price cut, the quality of BOSS Mixers and Hoists remains the same. They have always been noted for their heavy duty construction and materials. Under no consideration will we ever sacrifice this reputation. Get the catalogue. Note the specifications and compare the prices. You get the same patented Re-Mixing Action and other exclusive features that have made BOSSES preferred wherever used. Hundreds of BOSS machines have ten, twelve and fifteen years of continuous service behind them and still going strong. For quality of design, materials and construction we defy anyone to find a better built machine than a BOSS. You can now get all this for less.

BOSS 10S NON TILTER "One-Two Bagger" patented running action, steel construction, high speed performance with one man control.

Get Our Prices

Send Coupon for New Catalogue With Confidential Wholesale Prices

The new BOSS Catalogue gives complete information on all the BOSS Mixers, Pavers and Hoists along with the new confidential wholesale prices. Even if you do not want to order now, get this new catalogue and keep it on hand for future use. Fill in the coupon and mail today. It will save you money. Though you may have bought direct from a manufacturer before you have never been able to buy at these prices because no salesman's or jobber's commission is figured in. Prices on every machine are greatly reduced. Get the new catalogue with wholesale prices.

A COMPLETE LINE

We make over 79 various sizes, combinations and types of BOSS Mixers, Hoists and Pavers. There is a type for every conceivable use. Get the new catalogue first, then decide. Often our customers find that they can use a much lower priced machine after studying this catalogue. There is no need of going elsewhere for a certain machine when it is in the BOSS line. Write for catalogue and confidential wholesale prices; also give us information on kind of work you want the machine for. We can probably be of help to you.

NEW CATALOG—WITH WHOLESALE PRICES TELLS ALL!

1 YEAR GUARANTEE

GUARANTEE—All BOSS equipment is guaranteed for one year against defective materials and inferior workmanship. Any parts proving defective will be replaced free of charge (electrial or engine equipment excepted, as this equipment is guaranteed by the respective engine manufacturers) upon return to us of defective parts, carrier charges prepaid for our inspection.

American Cement Mach. Co., Inc.

THE BOSS 31/2S NON TILTER. One half bag drum type trailer mixer with 2 disc wheels, cushion rubber tires, batch hopper, 4 HP Stover engine, magneto, steel engine housing.

5 DAYS' FREE TRIAL

So confident are we that every BOSS Mixer and Hoist will give complete satisfaction, that we offer you five days' free trial. Order a BOSS. Use it in the field. If within five days you do not find it exactly as represented in every way, send for return instructions and refund of purchase price. This protects you; you can't go wrong on a BOSS. As long as we have sold on this basis, we have never had a customer demand his money. This proves BOSS quality. Every BOSS machine is backed up with an iron clad guarantee. Read it above.

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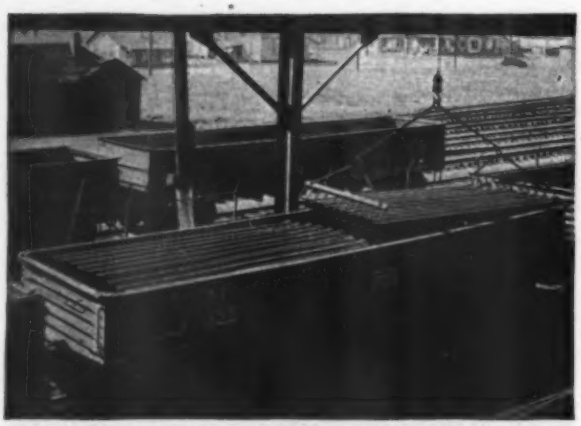


Loading the New 18-foot Lengths of De Lavaud Centrifugal Cast Iron Pipe

De Lavaud Pipe Available in 18-Foot Lengths

IN the early days of the manufacture of cast iron pipe, the individual lengths commonly produced were from 3 to 4 feet long. As the industry developed, these lengths were increased to 9 feet long which for a number of years was recognized as the standard length for cast iron pipe. Shortly after the introduction of vertical casting in dry sand molds, this length was increased to 12 feet which then became the recognized standard and still constitutes the major portion of cast iron pipe produced in the United States.

In 1914 individual lengths 16 feet long were produced under the vertical sand cast method and until the present time these were the longest individual lengths of cast iron pipe produced in the United States.

The United States Cast Iron Pipe & Foundry Co., Burlington, N. J., has announced that it is now manufacturing 18-foot lengths of de Lavaud centrifugal cast iron pipe in all diameters 4 to 12 inches inclusive. A battery of casting machines for the casting of de Lavaud pipe in 18-foot lengths is in operation at the Birmingham, Ala., plant.

The advantages of 18-foot pipe can be readily visualized when it is considered that as compared with 12-foot lengths of pipe there is a reduction of 33 1/3 per cent in the quantity of jointing material required, in the labor of making the joints themselves and the digging of bell holes. In the construction of plain end pipe lines for gas, the use of 18-foot lengths reduces the cost of couplings or special connecting pieces 33 1/3 per cent and correspondingly reduces the labor involved in the installation of such couplings or special connecting pieces. Another feature is that with the longer lengths, there are fewer joints, thus reducing the number of possible points of leakage in the finished line.

The manufacturer calls attention to the fact that the equipment for handling the 18-foot lengths of de Lavaud centrifugal pipe need be no different from that used in handling 12-foot lengths of cast iron pipe. For example, the standard weight of an 18-foot length of 8-inch Class 150 de Lavaud pipe used for 150 pounds maximum working pressure is 629 pounds, while the standard weight of a 12-foot length of 8-inch Class C sand cast pipe used for 130 pounds maximum working pressure is 625 pounds. In other words, while the 18-foot de Lavaud pipe is 6 feet longer than the 12-foot Class C sand cast pipe, it allows an additional working pressure of 20 pounds and weighs only 4 pounds more.

Because of the decreased weight per foot as compared with the same diameters of sand cast pipe, the same number of men can be used to install 18-foot lengths of de Lavaud pipe as are used for the installation of 12-foot lengths of sand cast pipe.

A New Line of Heavy-Duty Trucks

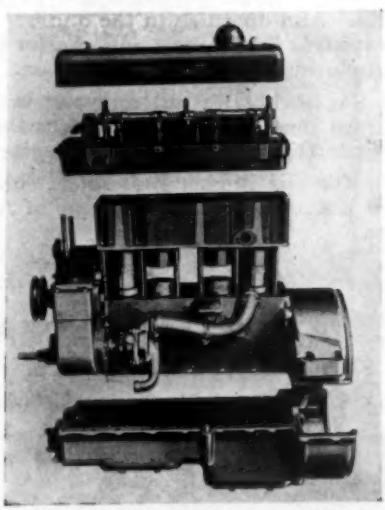
A NEW line of heavy-duty motor trucks with respective ratings of 2½, 3½ and 5 tons has recently been developed by the International Harvester Co., of America, 606 South Michigan Avenue, Chicago, Ill. These new trucks are made in both the chain-drive and double-reduction types with the exception of the 5-ton size which is of the chain-drive type only.

One of the important new features incorporated in the design of these new Internationals is the powerful engine which consists of five independently-maintained sub-assemblies, which simplify servicing and thus help to keep the truck on the job. The entire engine unit is compact, with all parts easily accessible. It has an overhead valve and camshaft arrangement, which is designed to simplify valve grinding, when necessary, and also is made so that lubrication is carried to every moving part. Another feature is the aluminum pistons, of the patented split-skirt type. Six piston rings are used, three of which are compression rings and the other three of which are oil wipers.

Lubrication of the engine is accomplished by means of a gear type oil pump, which forces the oil through a filter and thence into the main oil line, where it is distributed to main and connecting rod bearings by means of drilled holes. It is next conveyed to the cylinder head, where it is forced to the camshaft and valve-rocker-arm-shaft bearings, and finally it drains over the timing gear chain and sprockets. The oiling system completely supplies all moving parts, assuring longer life and added performance to the engine.

The new International truck is sturdy and powerful. The frame is heavy, with numerous cross members. The main springs on the double-reduction models are equipped with heavy auxiliary springs of the free-end cantilever type, while the auxiliary springs on the chain-drive models are of the semi-elliptic type with free ends. They are of strong steel, capable of standing up under the heaviest kind of hauling. The cab, which is roomy, comfortable and amply upholstered, is of durable steel to withstand any strain to which it might be subjected.

The steering control is the same "Steer Easy" arrangement which has been used on Internationals for a number of years. Other features are four-wheel brakes, single dry-plate clutches with vibration dampers and transmissions with five forward and two reverse speeds.



The Five Independently Maintained Sub-Assemblies That Make Up the Engine for the International Truck

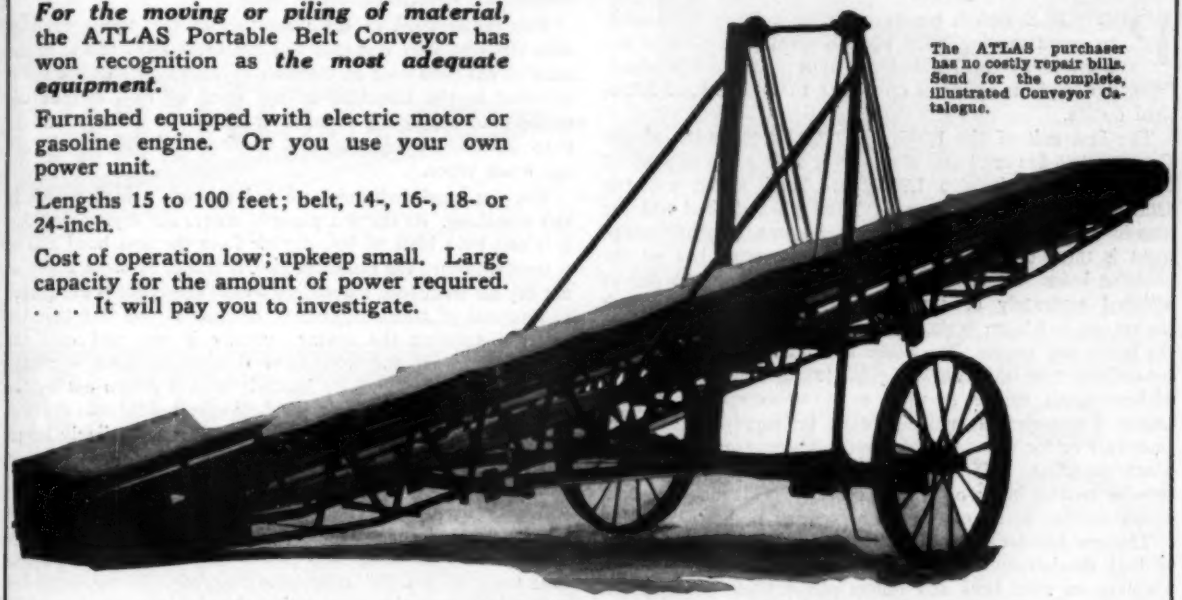
ATLAS Portable Belt CONVEYORS

For the moving or piling of material, the ATLAS Portable Belt Conveyor has won recognition as ***the most adequate equipment.***

Furnished equipped with electric motor or gasoline engine. Or you use your own power unit.

Lengths 15 to 100 feet; belt, 14-, 16-, 18- or 24-inch.

Cost of operation low; upkeep small. Large capacity for the amount of power required. . . . It will pay you to investigate.



The ATLAS purchaser has no costly repair bills. Send for the complete, illustrated Conveyor Catalogue.

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Box "N" — *Manufacturers of Bucket Elevators—Loaders—Tractors, Etc.* — Branch Office

Clintonville, Wisconsin — **Milwaukee, Wisconsin**

EUCLID WAGONS CUT EARTH MOVING COSTS

They make clean uniform fills. Because of the ease of dumping, the dirt is put in the right place without extra handling.

Operators prefer the Euclid because of the safe and convenient step position and easy door closing. These features in addition to the light draft and rugged construction of the Euclid result in fast, steady operation and an increased yardage.

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EUCLID

THE EUCLID CRANE & HOIST CO.

EUCLID, OHIO

Wheel Scrapers—Rotary Scrapers—Track-Wheel Wagons

A Three-Unit Portable Asphalt Plant

PORTABLE asphalt plants, made up in three units each, to speed moving them when necessary, have been announced by the F. D. Cummer & Son Co., Cleveland, Ohio. These plants are made up as 400, 1,000, 1,600 and 2,200-yard outfits.

The first unit of the 1,000-yard plant is composed of one Cummer two-fire sand and stone dryer with a capacity of 12 tons of sand per hour, a 1,000-pound batch mixer, a 12-ton sand bin with rotary screens, jacketed when desired and the bins in one, two, three or four compartments, standard equipment is three compartments, an open measuring box on the charging beam scales arranged so that each ingredient can be weighed separately or combined, and a 150-pound asphalt bucket on a 2-beam scale. The second unit is composed of the boiler and engine. The boiler is a 50-horsepower portable locomotive type unit operating at 125 pounds pressure. A 40-horsepower engine is used or a 40-horsepower electric motor. The boiler has ample capacity for supplying steam for tank cars or for other regular service where steam is required about the plant. The third unit in this Cummer plant is the one-fire melting kettle of 12 tons capacity. This may also be a steam melting kettle of the same capacity if desired.

The new two-fire dryer is claimed to embody the advantages of both the internal and the external fire types. The cylinder revolves on steel tires and rollers placed close to the front or feed end and to the discharger end and it is driven by suitable gears. The front end of the cylinder, except that part occupied by the front tire and supporting rollers, is enclosed by a fire brick and asbestos-lined casing for about one-half its length and this portion of the cylinder has heat inlet holes cut in its walls. These heat inlet openings are covered on the inside by hoods which allow the heat to enter, but prevent materials from leaking out. The rear half of the cylinder is not enclosed but is suitably insulated. The rear end of the cylinder is closed by a breeching to which an oil-burning combustion chamber is fitted.

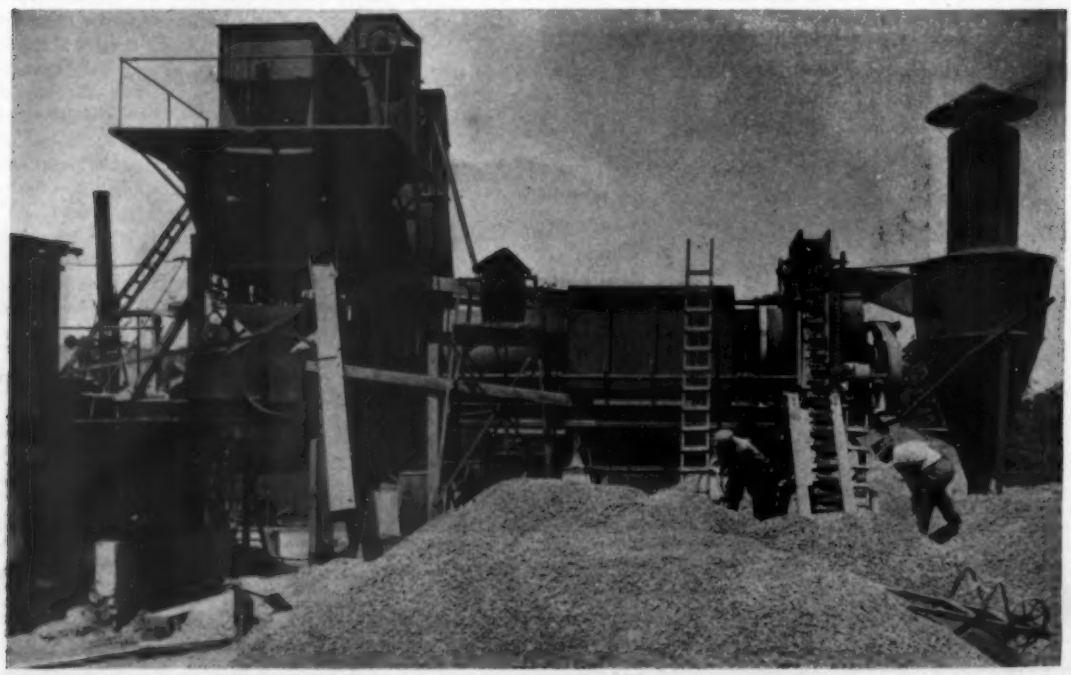
The casing around the front half of the cylinder extends considerably below the cylinder and forms a coal-burning furnace. At the forward end of this coal-burning furnace is fitted an oil-burning combustion chamber. Either coal or fuel oil can be burned, but oil is preferable.

This construction of the front half of the drying cylinder with the heat inlet openings and fire brick lined casing is the same as has been used on Cummer dryers in the past. A fan is attached to the breeching at the front or feed end of the cylinder to supply an induced draft to the furnace and to draw the heat through the inlet openings and also to carry off the water vapor.

The wet sand and stone are fed through a feed mouth in this breeching. As the wet material enters the drying cylinder, it is met by a blast of hot, dry air from the first hood and as it travels toward the discharge end, it is met by fresh blasts of hot dry air from each succeeding hood. These hoods are placed at intervals of about 18 inches. Because of the fact that the material entering the drying cylinder is wet and cold the heated air from the first hood quickly becomes saturated with moisture and loses its heat. It is then drawn out by the fans. The heated air from the following hoods loses its heat more slowly and stays in the cylinder a correspondingly longer time as the drying material works toward the discharge end, constantly becoming warmer and dryer.

The drying cylinder is designed so that the sand and stone will be warmed and almost dry before it passes the last heat inlet and the material then passes rearward into the drying heat from the rear oil combustion chamber. By regulating the supply of oil to this combustion chamber the dried material can be discharged at any desired temperature from 200 degrees Fahrenheit to 500 degrees Fahrenheit. The temperature of the sand and stone as it is discharged from the dryer is registered by a thermometer on the mixer platform in plain view of the mixer man and, as he is responsible for the temperature of the asphalt mixture, he also has control of the oil supply to the rear combustion chamber, so that he can at all times have the sand and stone discharged into the storage bins over the mixer at the proper temperatures.

This new plant has a 25% greater capacity than the earlier models and allows a 40% saving in fuel consumption.



The Complete 3-Unit Cummer 1,600-Yard Portable Asphalt Plant

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Distinctive in Man Power, Safety & Simplicity

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The World's Largest Manufacturers of Jacks
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Simplex ScrewJack with the Visible Screw

CUT OUT 20% OF OPERATING COST!

Cure "batch" troubles by accurate timing of your concrete mixer. Check performance of pump for valve condition. Time conveyors and machinery. Discover "lost motion" leaks.

Proper use of the "Paster" combination watch and stop watch will do it. Every contractor should carry one. Used by the U. S. Government after tests proved it the most durable stop watch made, regardless of price! Unbreakable crystal, nickel finish.

Fully Guaranteed!

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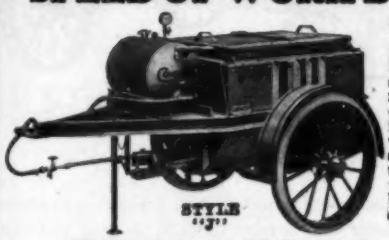

a Connery Style "J" oil-burning kettle. Here's a kettle that answers all requirements:—low fuel cost, quick heating, roller-bearing wheels and springs, absolute temperature control and solid rubber tires if desired.

We manufacture a full line of Tar and Asphalt Kettles, Oil Burning Kettles, Oil Burners, Torches, Pouring Pots, Hand Spraying Attachments, etc. Send for "Blue Book" describing our equipment.

Connery & Company, Inc.
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Hayward Buckets

—HAYCO—

Let Hayward Engineers recommend a bucket to fit the job. The Hayward line includes Clam Shell, Orange Peel, Drag Line and Electric Motor Buckets; Dredging, Excavating and Coal Handling Machinery; Automatic Take-up Reels; Counterweight Drums.

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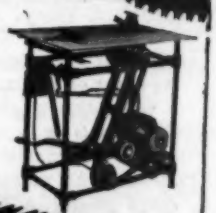
32-36 Dey Street New York, N. Y.

AMERICAN SAW MILL MACHINERY CO.

CONTRACTORS' TREADLE SAW

PORTABILITY, lightness, strength, power, adaptability, and low price combine to make this Contractors' Treadle Saw one of the most effectual and economical woodworking machines on the market. *Descriptive circular on request.*



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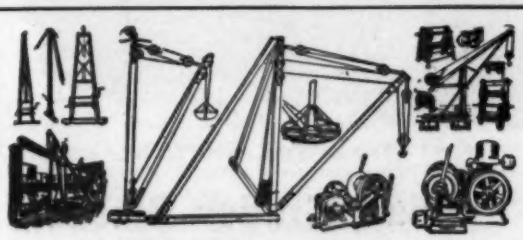
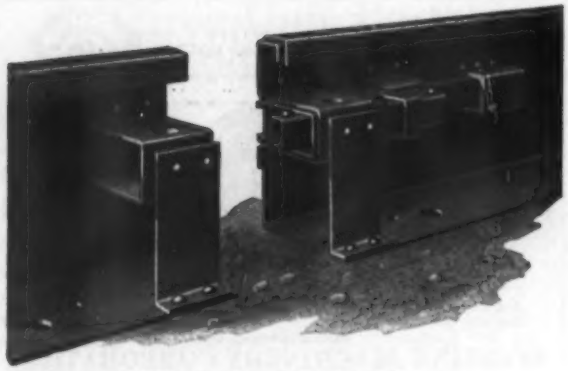


We have a complete line of Derricks and Winches

SASGEN DERRICK CO.
3101 Grand Ave. Chicago, Ill.



The Truscon Steel Road Form

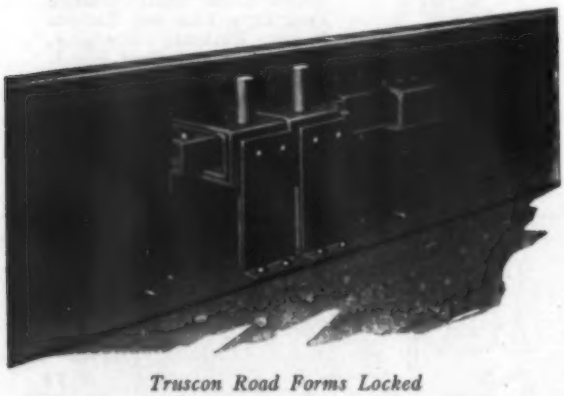
A New Steel Road Form

A NEW steel road form to which joint locks and other built-up parts are attached by 3/16-inch hot-driven rivets is now being manufactured by the Truscon Steel Co., Youngstown, Ohio. An advantage of this use of rivet-attached joint locks and other parts is that these parts may easily and quickly be replaced without any special equipment in case of damage to them. Either bolts or rivets may be used in making such repairs.

The new forms are completely interchangeable, each form being so made as to fit securely to the adjacent form, thus insuring true alignment of the joints. A 7-inch sliding member is driven through keyways on each two adjoining forms and is held by two stakes to form a rigid joint.

The stakes are each 3½ inches from the joint, giving double support where it is most needed. Other stakes may be used where necessary between the joints.

These forms are stamped from 3/16-inch steel by a special machine weighing 100 tons, all bending of the steel being accomplished in one operation on one die. This makes all forms uniform and results in even road surfaces where they are used. They will take bends of 100 feet radius, the short radius being obtained by the short locking apparatus at the joints, a special Truscon feature.



Truscon Road Forms Locked

Road Grader Blades

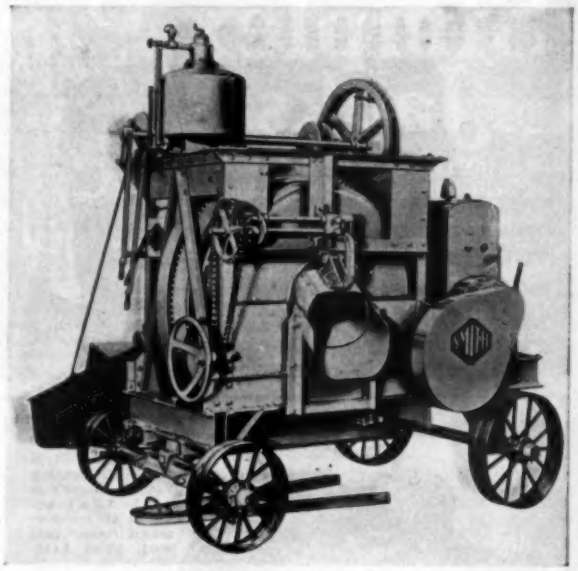
A NEW line of road grader blades, known as Empire, has recently been put on the market by the General Wheelbarrow Co., 3140 East 65th Street, Cleveland, Ohio. These blades come in many sizes and fit any of the various makes of road graders and maintainers now on the market.

The new Empire grader blades are made of a new special steel which has all the wearing qualities and resistance to abrasion of plow steel. In addition it has a new alloy content and method of rolling which gives it greater hardness and toughness.

A grader blade, like a knife or plane, will dull quickly if it is not set at the correct angle to the work. The new Empire blades have the exact curve to make them cut clean and retain their cutting edge in any kind of road work, both grading and maintaining. Another feature of Empire blades is the method of punching the bolt holes. The dimensions of every type of blade are reduced to a metal pattern, or template, to which the multiple punches are set. The holes are then gang punched, thus insuring an accurate fit of the blades, and making assembly easy.

A New ½-Yard Mixer

A NEW 14-S ½-yard non-tilting mixer has been introduced by the T. L. Smith Co., Milwaukee, Wis. This mixer, which is simple in construction and fast in operation, has a drum similar to those in other Smith mixers, but larger in diameter and narrower, with 10 deep full-width discharge buckets and bigger drum openings. This permits the use of a wider-throated skip and a wider discharge chute. Complete front-end operation is provided, with both the charge and discharge sides of the mixer visible. The drum rollers are equipped with oversize Timken bearings in dust tight housings. Other features of this new mixer are pressed steel drum heads, a short swinging discharge spout and an auxiliary stationary spout, band friction hoist clutch and brake, a low hot-riveted frame, forged steel rear axle brackets and wheels that turn under the frame for easy handling. The optional equipment includes a newly designed batch hopper with a large swinging gate.



The New 14-S ½-Yard Non-Tilting Smith Mixer

Coming Features

Among the outstanding articles to be included in coming issues of CONTRACTORS AND ENGINEERS MONTHLY *are a description of the construction of the Gorgas Steam Plant, hints on good management in grading, an account of the construction of a new concrete highway in New Mexico, the successful use of an elevator grader on rough grading, a discussion of the depreciation of construction equipment and other timely features sure to be of interest and value.*

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NU-METHOD FINISH-GRADER
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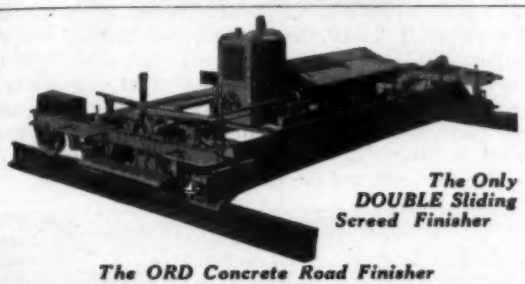

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The ORD Concrete Road Finisher

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ORD Concrete Road Finisher—Offers the simplest and cheapest method of obtaining the most consistently high-grade finish.

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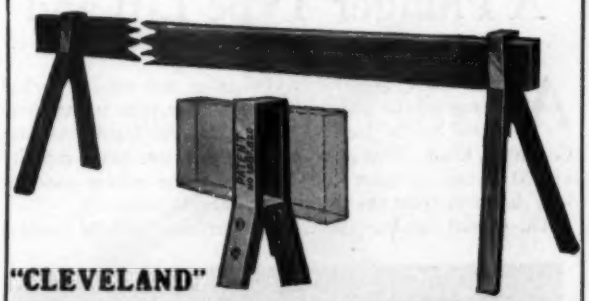

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Painted red—Height 30 in.—For 2 x 6 stringer.
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The Toledo Steel Horse

Folding Steel Horses

STEEL horses which can be set up ready for use in 30 seconds are manufactured by the Toledo Pressed Steel Co., Toledo, Ohio. These horses consist of two pressed steel A-frames which may be attached to any piece of 2-inch standard sized lumber to form a rigid and durable horse. The frames are of 3-inch ribbed channel sections with closed feet. All pivots are riveted.

The horses are made in two sizes, 25 inches and 32 inches. The latter is intended for highway barricade service, using either one pair to a rail to form a horizontal barricade or one frame and a rail to form the tripod type. The horses are finished in baked black enamel.

Detachment is as easily accomplished and the frames can be folded up with a single motion. The lumber used as a rail in the completed horse is not altered in any way and its use for other purposes is in no way impaired as no bolts, nails or screws are used. The rail is held by the equalized four-point positive grip of the saw tooth jaws, which insure absolute rigidity without the necessity of complicated mechanism.

A Plunger Type Lift and Force Pump

A COMPACT, portable, non-clogging and outside packed pump of the plunger lift and force type is manufactured by the Jaeger Machine Co., 701 Dublin Avenue, Columbus, Ohio. This pump in the 4-inch size has a capacity of 200 gallons of water per minute and can deliver water at long distances from the pump, if conditions require it.

The special construction of the water ways and the rotating rubber ball valves enable pumps to handle large quantities of solid matter without clogging. The outside packing allows tightening of the packing when the pump is operating and the air chamber in the discharge manifold relieves the strain on the hose.

A 4-cycle 9-horsepower Fuller & Johnson engine furnishes the power or, if desired, the pump may be equipped with electric power with the necessary gear reduction. The entire unit is compact, with complete accessibility. Port caps can be removed with a wrench or tool of any kind and the discharge valve parts placed at an angle to provide easy priming with a bucket of water. It is mounted on heavy steel trucks, with machine cut gears and die cast renewable bearings.

A Jaeger Non-Clogging Lift and Force Pump

Spreading Concrete Over the Havemeyer Barmats

Mats for Concrete Reinforcement

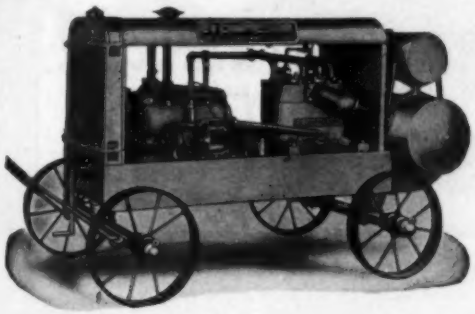
THE matter of reinforcing concrete has been one of considerable interest in recent years and several new features have been developed. Among them are the Havemeyer electrically-welded Barmats, which are manufactured by the Concrete Steel Co., 42 Broadway, New York.

These Barmats consist of Havemeyer bars of specific sizes welded into a complete reinforcing mat which is transported, handled and placed as a single unit. These bar mats have eliminated the necessity of hand tying in the field and thus speeded up construction work.

These mats are made to meet any specifications required, with any concentration of steel desired. They can be furnished in sheets 11 feet wide and 20 feet long but it has been found that for ease in handling the 9 foot 8 inches by 14 feet is the most practical size. The reinforcement may vary from 30 to 90 pounds of steel per 100 square feet for typical road jobs. Normally ⅜-inch round deformed bars are used but for very light jobs a combination of ¼-inch round and ⅜-inch bars may be specified.

The mats may be used in either one or two-layer reinforcement and if desired may be supported by chairs or supporting spacers, or the removable supporting devices which are also furnished by the Concrete Steel Co.

These devices, which are shown in the illustration, are designed to operate sucessfully with pavements which are being built half at a time or full width and have either one layer of reinforcements or two. They can be placed in position or removed in 10 seconds, using two men. They support the reinforcement at the proper point until the concrete has been deposited and brought up to grade, when they are released by pulling up the operating handle and are withdrawn to be used over again. With their use the operations of concreting can be considerably speeded up, with full assurance that the reinforcement will remain in the correct position in the slab.



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Particularly in the North, because it's so easy to start the engine in cold weather. The free engine clutch enables the operator to start the engine independently of the compressor.

Another fact worth noting is that it is the only compressor on the market with a balanced crankshaft and forced feed oiling system.

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PORTABLE BELT CONVEYORS

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20 inches or 24 inches wide
Gasoline or electric power
Maximum capacity assured by wide troughed belt without use of side boards to cut belt edges.

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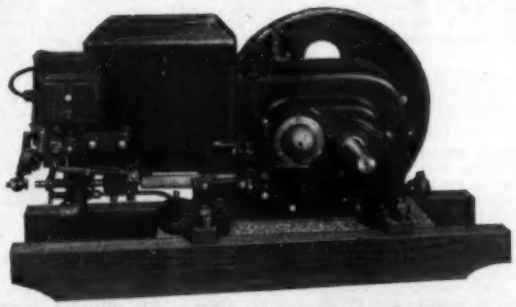

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The complete line of Rex plaster and mortar mixers, among the features of which are sturdiness, strong frames, double bearings at both ends of the paddle shafts, and protection against seepage of water and lime by coverplates sealed with grease, is described in Bulletin 177 which may be secured from the Chain Belt Co. (R. A. Shilbauer, Asst. Adv. Mgr.), 766 Park Street, Milwaukee, Wis.

PAVING AND CONSTRUCTION EQUIPMENT
The complete line of paving and construction equipment including finishing machines, subgraders, road forms, straight edges, mixers, steel towers, chuting equipment, buckets, carts and bins, are described in bulletins of the Lakewood Engineering Co. (Lion Gardiner, Vice Pres.), Cleveland, Ohio.

FOR QUICKER AND CHEAPER DIRT MOVING
This is the title of a folder describing the Groundhog revolving tractor scraper which revolves backward as well as forward and spreads or dumps on a pile by simply pulling a rope. The scraper is manufactured by the Roderick Lean Co. (Frank H. Smith, Sales Mgr.), Dept. 9, Mansfield, Ohio.

A BUCKET FOR EVERY DIGGING NEED
Buckets for every type of digging need and for every type of operating machine are described in a bulletin "Hayward Buckets Dig the World Over" which may be secured from the Hayward Co. (H. C. Ryder, Asst. Sales Mgr.), 32-36 Dey Street, New York.

COMPLETE LINE OF PNEUMATIC TOOLS
The complete line of Dayton pneumatic riveting hammers, chipping, calking and scaling hammers, jamb riveters, nail drivers and sand rammers, is described in literature which the Dayton Pneumatic Tool Corp. (L. B. George, Secy.), Dayton, Ohio, will be glad to send to those interested.

STEEL WHEELS FOR TRUCKS
Catalog 25-A contains a complete description of the entire line of steel wheels for various kinds of trucks which are manufactured by the Electric Wheel Co. (G. A. Tipton, Adv. Mgr.), Quincey, Ill.

A NEW 3½-YARD EXCAVATOR
Harnischfeger Corp. (H. S. Strouse, Adv. Mgr.), 38th & National Ave., Milwaukee, Wis., will be glad to send to those interested complete information in regard to its new fully revolving, convertible 3½-cubic yard excavator.

LANTERNS FOR DANGER SIGNALS
R. E. Dietz Co., 60 Laight Street, New York will be glad to send to those interested complete information in regard to its Little Giant red globe lantern for danger signals which will burn 70 hours without refilling.

STEEL BARRICADE SUPPORTS
The Cleveland Steel Specialty Corp., 6600 Park Ave., Cleveland, Ohio, has developed a riveted steel barricade support which is made sufficiently heavy to resist high wind pressure when supporting a horizontal stringer at a height of 30 inches from the ground, yet can be assembled, dismantled and easily handled by one man.

A FAST TRACTOR SHOVEL
The Bay City tractor shovel-crane trencher-dragline which is easily convertible and is a speedy worker is described in Catalog T-5 which may be obtained from the Bay City Shovels, Inc. (W. S. Ramsay, Pres.), Bay City, Mich.

RESURFACING WITH ASPHALT
Highway officials, highway engineers and contractors interested in resurfacing of old worn-out highways at low cost should secure a copy of Bulletin B-151 "New Highways at Half the Cost" issued by the Barber-Asphalt Co. (W. F. Hartzell, Adv. Mgr.), 1600 Arch St., Philadelphia, Pa., describing and illustrating the use of Trinidad and Bermudez native lake asphalts in resurfacing work.

COMPLETE LINE OF ROAD MACHINERY
The 1929 catalog describing the full line of Warco graders, scoops, crawlers and rollers, all having many new and improved features, which are manufactured by the W. A. Riddell Co., Dept. 3, Bucyrus, Ohio, may be secured by writing to W. A. Riddell, Pres.

A NEW TRACTOR
A new Caterpillar tractor, a sturdy new track-type tractor similar to the big Caterpillar but in a smaller size and known as Model Ten with a 14-horsepower engine delivering 10 horsepower at the drawbar, is described in literature which the Caterpillar Tractor Co. (W. H. Gardner, Adv. Mgr.), San Leandro, Calif., will send to those interested.

CONTRACTORS' EQUIPMENT
The C. H. & E. Mfg. Co., Inc., Milwaukee, Wis., will send to any one interested bulletins describing its complete line of portable saw rigs, hoists, pumps, mortar mixers, material elevators and other contractors' equipment.

FLEXIBLE IRON CULVERTS
The Armco flexible corrugated iron pipe which withstands the severest conditions of shifting soil, settling foundations, impact of traffic, pressure of freezing or swelling because of its flexibility, is described in literature of the Armco Culvert Manufacturers Assn. (Anton S. Rosing, Publicity Mgr.), Middletown, Ohio.

ROAD GRADER BLADES
Complete information in regard to the new line of Empire road grader blades, which are made of a special steel having all the wearing qualities of plow steel and in addition greater hardness and toughness, may be secured from the General Wheelbarrow Co. (W. A. Gordon, Sales Mgr.), 3410 East 65th Street, Cleveland, Ohio.

A NEW ½-YARD MIXER
A new 14-S ½-yard non-tilting mixer, which is similar to other Smith mixers but has a larger drum and 10 deeper full-width discharge buckets, is described in literature of the T. L. Smith Co. (G. W. Pollock, Sales Mgr.), 1125 32nd Street, Milwaukee, Wis.

A NEW LINE OF HEAVY-DUTY TRUCKS
The International Harvester Co. of America, Inc., 606 So. Michigan Avenue, Chicago, Ill., will be glad to send to those interested complete information in regard to its new line of heavy-duty trucks, built in both the chain-drive and double-reduction types, and with ratings of 2½, 3½ and 5 tons.

A NEW DEVELOPMENT IN DEAD-END SLINGS
Complete information in regard to the new development in dead-end slings by the use of preformed wire rope which permits the use of an attached compact and positive fitting, may be secured from the American Cable Co., 315 North Michigan Avenue, Chicago, Ill.

NEW FLOODLIGHTING PROJECTORS
The General Electric Co. (F. H. Winkley, Mgr. of Sales), Schenectady, N. Y., will send to those interested complete information in regard to the new line of floodlighting projectors, in three types, which may be used for lighting buildings, yards, docks, night construction work and similar purposes.

A NEW STEEL ARMORING FOR FLOORS AND ROADS
Floorgard, a new steel armoring for reinforcing concrete, asphalt and composition floor surfaces which is a built-up continuous steel mat of a number of steel strips held together with small circular tie rods, is described in literature, which may be secured from Blaw-Knox Co. (D. Clinton Grove, Adv. Mgr.), 667 Farmers Bank Bldg., Pittsburgh, Pa.

A DEPENDABLE TRENCHER
The Parsons Co. (N. DeWind, Vice-Pres.), Newton, Iowa, will be glad to send to those interested complete information in regard to the Parsons 40, a sturdy and dependable digger which has surplus power, four digging speeds, differential gearing to increase mobility and extra-strong construction.

AN IMPROVED LINE OF WHEELBARROWS
A complete new catalog describing in full the improved F line of sturdy and rigidly-constructed wheelbarrows may be secured from the Lansing Co. (S. E. Race, Sales Mgr.), Lansing, Mich.

SERVICE THAT SAVES
The Twin Disc Clutch Co. (P. H. Batten, Pres.), Racine, Wis., will be glad to send to those interested full information in regard to Twin Disc clutches which for many years have done reliable and satisfactory service on a large number of machines used by contractors.

A STEEL BACKBONE FOR CONCRETE
Longer concrete life and a lastingly good surface are insured by the use of wire mesh made of cold drawn steel which is described in the Road Book which the American Steel & Wire Co. (Wilmer H. Cordes, Mgr. Adv. Dept.), 208 So. LaSalle St., Chicago, Ill., will send to those interested.

ROAD BUILDING EQUIPMENT
A complete line of road building equipment, including tandem wheelers, rooters, road plows, scrapers, hoists, scarifiers, graders, drags, culverts, and others, is described in a 32-page booklet which may be secured from the Beach Mfg. Co., Charlotte, Mich.

VALUABLE HAND BOOK ON INDUSTRIAL MESH
The Steelcrete Industrial Mesh Handbook, describing and illustrating the methods of making machine guards, window guards, partitions, and enclosures from open mesh material, is put out by the Consolidated Expended Metal Cos. (Thomas R. Herberst, Jr., Vice Pres.), Wheeling, West Va., and may be secured without charge by writing them.

WHEELBARROWS OF ALL STYLES
Catalog No. 9 contains a complete description of Chattanooga Wheelbarrows in all styles and sizes for every possible need and may be secured from the Chattanooga Wheelbarrow Co. (T. M. Gillespie, Gen. Mgr.), Chattanooga, Tenn.

A TRAILER TOOL BOX
A complete description of the Mohawk Hi-Speed trailer tool box into which the tools can be loaded, the cover locked and then hooked on to the truck to be moved to the next job may be secured from the Mohawk Asphalt Heater Co. (John Van Vorst, Pres.), Schenectady, N. Y.

A NEW TWIN 6 TO 10-HORSEPOWER ENGINE
The New-Way Motor Co. (W. H. Newbrough, Pres.), Lansing, Mich., will be glad to send to those interested complete information in regard to its new twin-cylinder air-cooled motor which is particularly adaptable to jobs where water is difficult to secure, where the engine is subjected to extreme heat or cold, and where light weight is an important factor.

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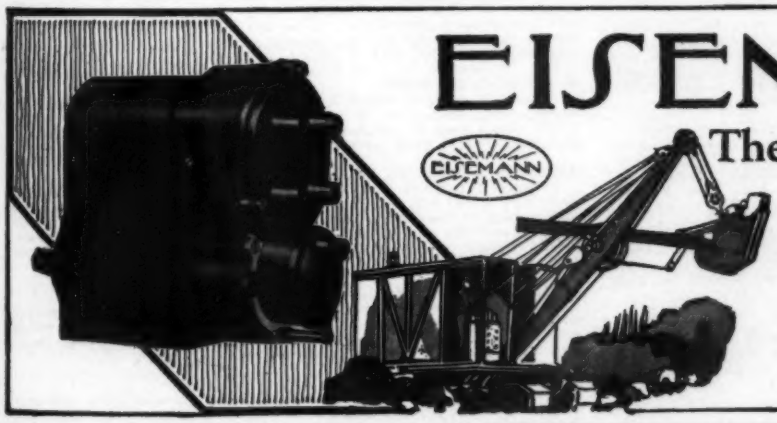

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COMPRESSORS AND PAVEMENT BREAKERS
Thor compressors which are equipped with Rix super-chargers and Thor paving breakers which give a powerful hard hitting blow, are described in literature which may be secured from the Independent Pneumatic Tool Co. (F. R. Pfaff, Adv. Mgr.), 248 So. Jefferson St., Chicago, Ill.

HEAVY-DUTY TRACTORS
Allis-Chalmers Manufacturing Co., Monarch Tractors Division (Harry G. Hoffman, Adv. Mgr.), Milwaukee, Wis., will be glad to send to any one interested complete information in regard to the Monarch 50 and 75 tractors which are specially designed and constructed for maintenance work, tough grader operations, heavy hauling and any other type of work demanding a heavy-duty piece of equipment.

NEW 3½-TON HOIST
A new hoist, known as the WH, designed to handle loads up to 3½ tons, with a standard line speed of 250 feet per minute, has been announced by the Novo Engine Co., Lansing, Mich., from whom complete information and prices may be secured.

STONE SPREADER FOR USE IN ROAD CONSTRUCTION
The Burch Corp. (C. R. Beaver, Sales Mgr.), Crestline, Ohio, will be glad to send to those interested a booklet describing in detail the Burch spreaders for distributing sand, gravel, chips or stone in the construction of high grade macadam roads.

BOLTED AND WELDED STORAGE TANKS
Bolted and welded tanks for oil, water, brine and various liquid and dry commodities, which are shipped in sections and are bolted together with special gasket and cement, are described in literature which may be secured from the Columbian Steel Tank Co., Kansas City, Mo.

CREEPER WHEELS FOR ROUGH GOING
An illustrated booklet describing the creeper wheels which keep right on going through mud and mire, over stumps, roots, hollows and holes, will be sent to those interested by the Creeper Wheel Co., 602 Colonial Trust Bldg., Reading Pa.

REPAIR PARTS FOR TRENCH MACHINES AND DITCHERS
Bulletins describing the Oro repair parts with Rix super-chargers and trench machines, Parsons public service ditcher and the B-G loaders which are made of Oro steel may be secured from the Kensington Steel Co. (W. S. McKee, Pres.), 505 Kensington Avenue, Chicago, Ill.

CONTRACTORS' WHEELBARROWS
A 36-page booklet "Jackson Barrows" contains a complete description of the many kinds of contractors', stone, brick and tile, concrete and general purpose wheelbarrows and may be secured from the Jackson Mfg. Co. (J. E. Core, Sales Mgr.), Harrisburg, Pa.

A CONTRACTORS' TREADLE SAW
A descriptive circular containing full details in regard to the portable, light, adaptable yet strong and powerful contractors' treadle saw may be secured from the American Saw Mill Machinery Co. (W. E. Swanger, Mgr.), 171 Main St., Hackettstown, N. J.

A SPEEDY AND POWERFUL LOCOMOTIVE
Complete information in regard to the Brookville locomotives which are powered by McCormick-Deering and International power units and give dependable service in road construction, street building and general contracting work, may be obtained from the Brookville Locomotive Co. (B. Eiseman, Mgr.), Brookville, Pa.

LIGHT FOR CONTRACTING JOBS
Carbide lanterns which give a dependable, strong, clear and penetrating light for all kinds of contracting work are described in literature which may be secured from the National Carbide Sales Corp. (W. E. Keeley, Jr., Vice-Pres.), 342 Madison Ave., New York.

A QUICK-HEATING OIL-BURNING KETTLE
A Blue Book describing the Style J oil-burning kettle, among the features of which are low fuel cost, quick heating, roller bearing wheels and springs, absolute temperature control and solid rubber tires, may be secured from Connery & Co., Inc. (W. B. Roberts, Asst. Secy.), 4000 N. Second St., Philadelphia, Pa.

A COMPLETE LINE OF PAVERS
A complete line of pavers, including 27-E, 13-E and 10-E, are described in literature which the Ransome Concrete Machinery Co. (A. P. Robinson, Sales Mgr.), Dunellen, N. J., will be glad to send to those interested.

DEPENDABLE ENGINES
Dependable engines, ranging in sizes from 3 to 160 horsepower, and giving full measure of power at low operating costs, are described in literature which the LeRoi Co. (W. R. Karll, Sales Mgr.), Milwaukee, Wis., will be glad to send to those interested.

DEMOLITION WITH PILE HAMMERS
Bulletin 37 contains a detailed description with illustrations of the use of McKiernan-Terry double-acting pile hammers in demolition and may be secured from McKiernan-Terry Drill Co. (C. S. Ackley, Secy.), 19 Park Row, New York.

WAGONS FOR EARTH MOVING
Euclid wagons for earth moving, the features of which include ease of dumping, clean uniform fills, safe and convenient stop position and easy door closing, are described in literature which may be secured from the Euclid Crane & Hoist Co. (A. P. Armington, Sales Mgr.), Euclid, Ohio.

EXPANSION JOINTS FOR PROTECTION
W. R. Meadows, Inc. (W. R. Meadows, Pres.), Elgin, Ill., will be glad to send to those interested a complete description of the Sealtight expansion joints which insure protection for concrete roads.

CONCRETE TESTING AND INSPECTION
Complete information in regard to the inspection service of Robert W. Hunt Co. (Robert N. Macalister, Publicity Dept.), 2200 Insurance Exchange, Chicago, Ill., for testing all reinforced concrete materials, designing of concrete mixes, crushing concrete cylinders as well as for inspection of all classes of concrete construction will be furnished on request.

A FULL-REVOLVING CONVERTIBLE EXCAVATOR
Bulletin 2805, containing a full description with illustrations of the full-revolving, convertible ½-yard General excavator which is designed for efficient and dependable service as a shovel, clamshell, dragline, backhoe, skimmer, crane or backfiller, may be secured from the General Excavator Co. (F. B. Morrison, Sales Mgr.), 200-274 Rose Street, Marion, Ohio.

LIGHTS WHICH PENETRATE
Carbic lights which penetrate through dust, smoke or fog with a clear white light perfectly diffused are manufactured by the Oxweld Acetylene Co. (T. C. Fetherston, Mgr. Tech. Publicity Dept.), Carbide and Carbon Bldg., New York.

ALL-STEEL DERRICKS
Dobbie Foundry & Machine Co., Niagara Falls, N. Y., will be glad to send to any one interested complete information in regard to all-steel Dobbie derricks which save power by using ball bearing footlocks and sheaves and which are built in both guy and stiff-leg types.

A SPEEDY AND CONVENIENT PIPE CUTTER
A circular describing the Ellis pipe cutter which has six keen rotary cutting blades for all kinds of pipe up to 12 inches in diameter may be secured from Ellis & Ford Manufacturing Co. (Herman A. Sperlich, Pres.), 32 Piquette Ave., Detroit, Mich.

COMPLETE LINE OF PUMPS AND EQUIPMENT
The Labour Co., Elkhart, Ind., will be glad to send to those interested complete information in regard to its line of pumps, valves and pump equipment.

CONTRACTORS' BUCKETS
Complete data and prices of the Contractors', Hi-Power and Lever-Arm clamshell buckets which meet every need in the construction field may be secured from George Haiss Manufacturing Co., Inc. (A. W. Haiss, Pres.), 142nd St. and Park Ave., New York.

A COMPLETE LINE OF CONTRACTORS' PUMPS
The complete line of Humphryes pumps which are designed for greater capacities and higher lifts for contracting service are described in bulletins which may be secured from the Humphryes Manufacturing Co., Mansfield, Ohio.

SEWER PIPE JOINT MATERIAL
A folder describing No. 1 Korite, an asphaltic product for making leak-proof sewer pipe joints may be secured on request from the Standard Oil Co. of Indiana (C. C. Lakin, Mgr., Asphalt Dept.), 910 South Michigan Ave., Chicago, Ill.

A THREE-UNIT PORTABLE ASPHALT PLANT
Portable asphalt plants made up in three units each to speed moving them when necessary and in 400,1000, 1600 and 2200-yard capacities, are described in an illustrated 24-page booklet which may be secured on request from F. D. Cummer & Son Co. (I. Freeman, Secy.), Cleveland, Ohio.

SLACKLINE CABLEWAYS
A booklet "Excavating for Profit" which describes the Sauerman slackline cableway for handling both little and big excavating jobs where the materials have to be dug, elevated and conveyed from the pit may be secured from Sauerman Bros., Inc. (Louis McLouth, Adv. Mgr.), 464 So. Clinton Street, Chicago, Ill.

A ONE-MAN SCRAPER
A one-man scraper, which loads, dumps, spreads and levels and is made in four stock sizes, 4, 5, 6 and 7 feet wide, is described in circulars which may be secured from the Gustav Schaefer Co. (Ernest Schaefer, Secy.), 4180 Lorain Ave., Cleveland, Ohio.

ASPHALT PRODUCTS FOR ROAD CONSTRUCTION
Standard Oil Co. of New York (B. L. Boye, Sales Mgr.), 26 Broadway, New York, will be glad to send to any one interested complete information in regard to its asphalt binders for surface treatment, penetration work and mixing, asphalt joint fillers, cold patch asphalt, refined asphalt for sheet asphalt paving, paving flux, bridge asphalt and preserving oils.

A PULLSCOOP WITH ELECTRIC TRIP
A pullscoop with electric trip which dumps accurately and quickly without spillage or waste of time is described in literature which the Keystone Driller Co. (J. V. Downie, Adv. Mgr.), Beaver Falls, Pa., will be glad to send to those interested.

FOLDING STEEL HORSES
Folding steel horses, which consist of two pressed steel A-frames to be used with any 2-inch piece of lumber as the rail, are described in literature which may be secured from the Toledo Pressed Steel Co. (Lyman W. Close, Vice-Pres.), Toledo, Ohio.

PERMANENT PROTECTION AGAINST RUST AND CORROSION
Semet-Solvay Hydraulic and Semet-Solvay Multiproof paints for protecting and preserving structural and submerged steel are described in literature which may be secured from the Semet-Solvay Co., 61 Broadway, New York.

A PLUNGER TYPE LIFT AND FORCE PUMP
Bulletin P-29 describing in detail the compact, portable, non-clogging and outside packed pump of plunger lift and force type, the special construction of which permits the handling of large quantities of solid matter without clogging, may be secured from the Jaeger Machine Co. (O. G. Mandt, Vice-Pres.), 701 Dublin Avenue, Columbus, Ohio.

A STOP WATCH FOR ACCURATE TIMING
The Sterling Stop Watch Co., Dept. C, 15 East 26th Street, New York, will be glad to send to those interested complete information in regard to the combination Sterling watch and stop watch for timing concrete mixing, conveyors and equipment and such service in the construction industry.

A DRAG SCRAPER HOIST FOR MOUNTING ON MOTOR TRUCK
A recent 8-page booklet describing the complete line of American gasoline hoists, including the American two-speed drag scraper gasoline hoist which is designed for any kind of drag scraper work within its capacity and which may be mounted on a motor truck, may be secured from the American Hoist & Derrick Co. (H. S. Johnson, Vice-Pres.), St. Paul, Minn.